

August 1988

AN INTERTEC PUBLICATION

Volume 6, Issue 8

Mobile Radio Technology

The journal of mobile communications technology



Using spectrum analyzers at cell sites, p. 10

**Digital multimeters
Data transmission
Expo/East preshow overview**

We've got to hand it to you

You've made our "On-Glass"® cellular antennas the standard of the industry, choosing them for more than 70% of all cellular mobile phone installations.

And as we keep working, constantly pushing technology forward, we'll continue to provide you with the best—and here's how:

"On-Glass"® II

The latest generation cellular antenna.

We've meticulously refined the best cellular antenna to give you even greater ease of installation and, most importantly, to give your customers outstanding performance and reliability.

- ✓ no defroster grid interference—sophisticated new coupler foot is designed to fit between horizontal grids
- ✓ no field tuning needed—precision factory tuned
- ✓ ingenious waterproof quick-removal whip connection
- ✓ tough, contemporary black DURA-COAT™ finish
- ✓ smallest silhouette for less visual distraction
- ✓ mini-connector at coupler for speedy cable runs
- ✓ single screw adjustment for vertical whip positioning



Send now for "The Book" on cellular antennas—the most authoritative, understandable, and useful information package on cellular antenna systems ever. Yours free!

the antenna specialists co.

a member of The Allen Group Inc.

30500 Bruce Industrial Parkway
Cleveland, OH 44139-3996
216/349-8400



® "Stripes of Quality"

Circle (1) on Fast Fact Card

For every remote possibility!



Tone-remote and DC-remote desk-top consoles

Cetec Vega offers tone-remote and DC-remote consoles for virtually all applications. Some of the popular console types shown above include:

- Two-frequency EIA sequential tone
- Four- and eight-frequency EIA
- Dial-up (plugs into ordinary telephone line)
- PTT/monitor DC
- Full-function DC

- Vega "SPEECH-PLUS" and other continuous-tone formats
- Multiple-line
- OEM and custom (special features and extended functionality)

Most Cetec Vega consoles offer a wide array of deluxe features at no extra cost, such as:

- Multifrequency (2, 4, or 8) operation
- Selectable 2-W simplex or 4-W full-duplex operation
- Intercom function
- High-performance audio with 2-way compression
- Reliable push-button switches

Also standard is the reliability, quality, and support you expect from Cetec Vega.

For applications assistance, custom designs, and special requirements, call 1-800-877-1771 (and remember to ask for your Signaling Products Catalog).



Division of Cetec Corporation

9900 Baldwin Place
El Monte, California 91731
Telephone: 800-877-1771;
(818) 442-0782
Telex II: 910-587-3539
FAX: (818) 444-1342

features

10 Using a spectrum analyzer in cell site service

Carl Pepple, Marconi Instruments

The key to correct diagnosis lies in knowing how to "read the charts."

16 Getting the most from digital multimeters

William L. Detwiler, Helper Instruments

Use your DMM to find a short-circuited plus lead in a portable.

26 ACSSB advancements improve data transmission

Douglas P. Collette, Aerotron
Synchronous transmit-receive control offers higher data speeds with less error-correction by overcoming multipath fading effects.

42 Expo/East preshow overview

Here's what to look for during the Expo/East trade show, Sept. 14-16, in Atlanta.

departments

4 Editorial

Open architecture.

6 Letters to the editor

Reactions from ion dissipator manufacturers.

44 News

Radius slowly accepts dealers.

58 Regulating technology

NABER boosts membership services and programs.

66 New products

S&S Manufacturing, Dynascan Cobra and Lightning Prevention Systems are the "Readers' Choice."

102 Literature

Marconi releases bulletins.

104 Feedback

Product serviceability triggers reader responses.

108 People

Promotions at Maxon and Selectone.

109 Calendar

Little Rock, AR, hosts APCO.

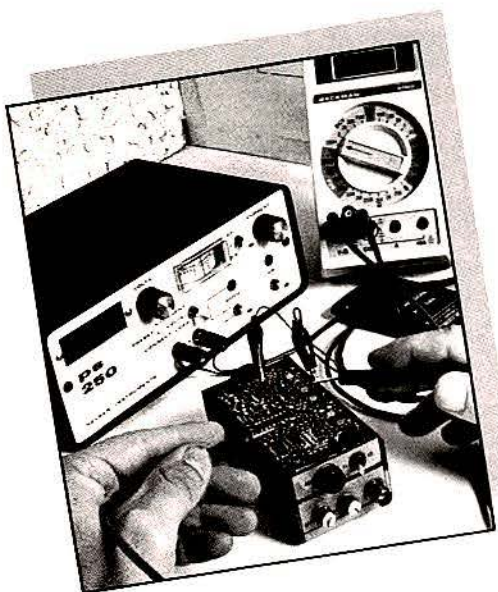
112 Classified ads

120 Ad index/hotline

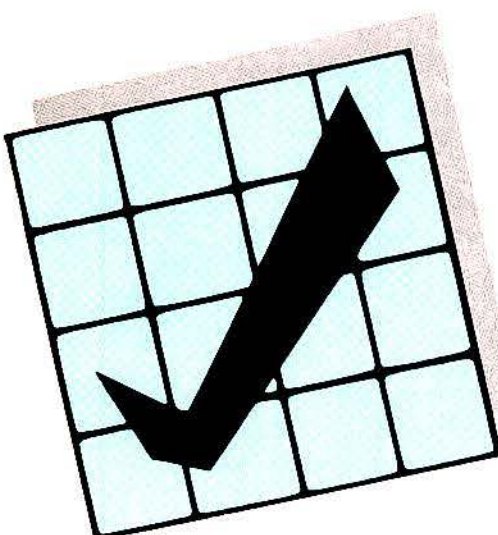
Find advertisers quickly.

121 What do you think?

What do technicians' jobs entail?



page 16



page 42

On the cover: The spectrum analyzer can provide exacting information on the health of a cell-site transmitter. See article on page 10. Artwork courtesy of Marconi Instruments.

©1988 **Mobile Radio Technology** (ISSN 0745-7626) is published monthly by Intertec Publishing Corporation, 9221 Quivira Road, Overland Park, KS. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address changes to **MOBILE RADIO TECHNOLOGY**, P.O. Box 12960, Overland Park, KS 66212.



**New
DC or Tone
Remote
Control**

Wall mount

Higher profit margins, reliability you can count on, and fast delivery. That's SSC.

You win the bid. With a 50% markup.

To make it easier for you to maintain higher profit margins, we keep our prices extra competitive.

We can do it, because signalling is our specialty.

You'll like our reliability.

Profits disappear quickly if you have to make several service calls—at your expense!

You'll be pleased with the reliability SSC delivers. It's backed up with a five-year limited warranty.

You get your order when you want it. Fast.

A recent survey showed there's a 90+ percent chance your order will be shipped within five working days of SSC's receipt of your order.

In any case, we'll give you a firm shipping date and we'll make it happen.

Full-line of signalling products.

Take your pick. DC and tone remote control units, DC to tone converters, ANI encoders and displays, CTCSS, single-tone, two-tone sequential, and Touch-Tone® units.

The new desktop or wall-mount remote control console pictured above is available in DC or tone, with a full range of features. You can field program it during installation to ensure system compatibility.

Ask for information. It's free.

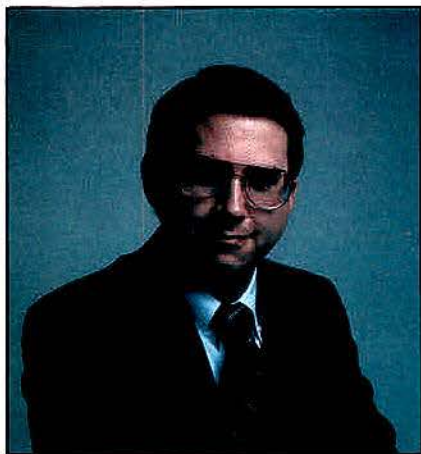
You'll receive a complete package of information on signalling products designed to raise your profit margins. Contact Solid-State Communications, 21060 Corsair Blvd., Hayward, CA 94545.

SSC **One source for all
your signalling needs.**

Call now for full information package:

Circle (5) on Fast Fact Card

800-227-1226 IN CA **800-227-0223**



Open architecture

Imagine this: Trunked public safety radio equipment costs less, instead of more. Add-on equipment can be selected through the bidding process.

If efforts undertaken by Open Architecture Radio for Public Safety (OARPS) succeed, maybe these possibilities will come to pass. (See "Public Safety Group Seeks Open Architecture," page 50.)

Competition

"Open architecture" trunking means all manufacturers use the same transmission protocol to control the handshake between the two-way trunked radio and the central controller switch. It makes different brands compatible and fosters competition not only when an initial system is sold, but when expansions are proposed and aging equipment is replaced.

What does competition *really* mean? Because Motorola has an estimated 98% market share of public safety trunked radio sales, competition today means the ability to sell equipment onto Motorola systems.

Motorola management cannot magnanimously open its architecture to use by competitors, possibly surrendering market share, without arousing the ire of shareholders who have a stake in the company's dominant position. It does not *need* to; the company offers a complete product line.

The government cannot violate any company's proprietary rights to its own technology, so it cannot *force* Motorola or any other company to let others use proprietary technology.

How, then, can competition indirectly gain access to the public safety trunked radio market?

By making the alternative so untenable that Motorola voluntarily opens its architecture—by actually bringing the government to the brink of declaring *some other* protocol the standard.

No FCC enthusiasm

The FCC staff has no enthusiasm for a trunking standard. None of the commissioners, except for James Quello, has enthusiasm for one, either.

For the FCC to be stirred to endorse a trunking standard will require public

support or Congressional pressure, or both. A Congressional *directive* would suffice.

The Associated Public-Safety Communications Officers (APCO) wants *no* delay in the release of new frequencies. Consideration of a trunking standard may cause a delay, so the public safety association does not support OARPS. APCO does not object to a standard, just the potential delay.

Thus, support from the public safety community has to come from individual agencies or, perhaps, from regional planning committees operating under the auspices of the National Public Safety Planning Advisory Committee. Do enough individual agencies *want* lower prices competition usually brings? OARPS is shaking out those that do.

Do enough local governments *want* trunked radio system purchasing options? OARPS is drawing out those that do.

If the only substantial support for a trunking standard comes from competing manufacturers, the initiative will fail.

Crystal ball

We see the process unfolding in this way:

- The FCC responds to public and legislative pressure and initiates an inquiry into establishing a standard, inviting proposals.
- Congress backs the FCC with legislation declaring such a standard to be necessary for public safety, reducing the risk that litigation will follow the selection of a standard.
- Each manufacturer proposes its current protocol as a standard.
- Public comment favors the Motorola protocol, and it is chosen as the standard.

It is not a pretty process, but it is the way competitors can make use of government machinery to gain entry into the public safety trunked radio market.

—Don Bishop

PRIVACY

Volume 1, No. 3

NEWS
from
transcript

NEW TECHNOLOGY FOR TODAY'S RADIOS

Nobody does it better

When you need voice privacy, Transcript has the system for you. And nobody does it better!

Full Range. From the reliable SC-400 to the amazing SC-460 computer controlled system, nothing else even comes close.

Performance. Transcript customers enjoy voice quality and radio performance unmatched by any other system.

Installation. Transcript can fit virtually any radio — mobile, portable or base — unit, with simple easy-to-follow instructions. We support over 300 models from 35 different manufacturers and are adding new ones every day.

Satisfaction. Transcript is responsive to customer needs and provides fast, efficient service.



Each postage-stamp-sized Transcript CVP™ controller is equipped with a powerful Motorola microprocessor.

Crypto Voice Plus™, Transcript's exclusive CVP, provides outstanding features and capabilities not found in any other system. The SC-460 provides ANI, Status, Emergency and many other features in addition to CVP. Radio codes can actually be changed over the air by the dispatcher.

Computer Aided Radio Dispatch™ is optional with the SC-460 CVP III system. With CARD™, a simple PC can monitor and control an entire radio system. Several different systems can be controlled by a single PC at the same time.

The CARD software is easy to use. Each screen uses color to clearly display unit status information. Helpful windows provide control.

And the cost of CARD is surprisingly low.

SC-400 Reliable voice privacy

4 codes inversion

SC-440 CVP I medium privacy

256 codes

SC-450 CVP II high privacy

4096 codes

SC-460 CVP III very high

privacy

Over 100 billion codes

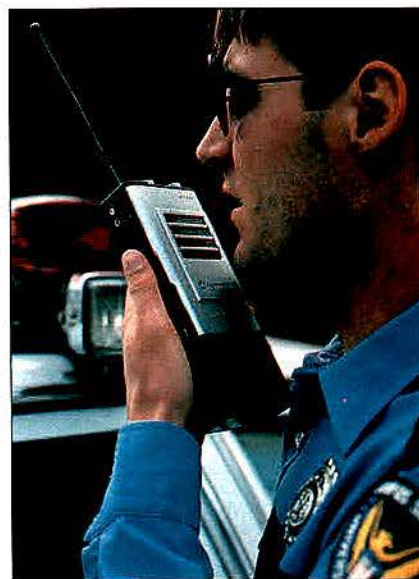
ANI, Unit Status

Emergency

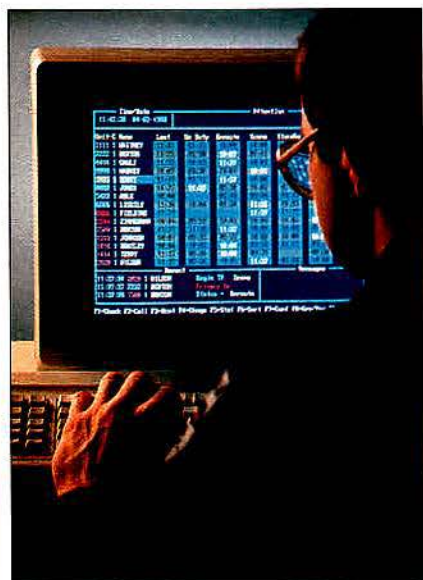
Remote Disable &

optional Computer Aided

Dispatch control



Transcript CVP™ controllers fit inside virtually any two-way radio — mobile, portable or base station.



Easy computer control for any radio system, small or large, single or multi-frequency. The Transcript CARD system sets a new standard for the industry.



transcript international INC

Toll-Free (800) 228-0226 Telex 466146
1620 North 20th Street, Lincoln, NE 68503

Regarding the April 1988 article, "Dissipation arrays: Do they work?": I would like to clarify some points.

- First, arrays of dissipators are not used to neutralize a thundercloud. They simply remove the lightning-attracting charge on a tower relative to other objects in the area, thereby eliminating strikes to the tower.

- Second, arrays, such as the one we manufacture, use at least 40,000 points of dissipation per array, making them much more effective than the type of arrays used in the 1975 Office of Naval Research study.

- Third, the arc-over experiment described in the article does not represent dissipation technology because it does not take into account proper distances, wind velocity, corona currents, potential gradients and many other naturally occurring conditions.

Although proper grounding techniques are important for lightning protection, adding arrays of dissipators enhances the effectiveness of any lightning protection system to a great degree. Dissipative systems continue to gain

popularity because of their effectiveness.

W. Gregg Fawthrop

President

Lightning Prevention Systems

Berlin, NJ

My reaction to Roger R. Block's April 1988 article, "Dissipation arrays: Do they work?" passed quickly from amusement to shocked disbelief. I found the explanation offered of how static dissipators operate to be profoundly erroneous.

The conclusion that static dissipators are ineffective for protection from lightning damage cannot be credible if it is based on a false premise. If I may offer an analogy in illustration:

"The space shuttle is propelled by a large flock of birds attached to it by small wires. Mathematical analysis proves it is impossible to attach enough birds to the shuttle because there is not enough surface area to attach as many birds and wires as would be required to lift it. Even if the birds could lift the shuttle from the launch pad, the vacuum of space offers insufficient lift for bird

flight. Therefore, it is not possible for the space shuttle to fly."

Similarly, the article offers in its first paragraph an incorrect explanation of the operation of static dissipators ("they neutralize the cloud's electrical charge") and proceeds to prove throughout the remainder of the article that dissipators cannot possibly perform that function. But static dissipators do not work by neutralizing storm cloud charge. They work by dissipating static ground charge to the atmosphere at a rate sufficient to reduce the likelihood of a direct lightning strike to the object of structure whose charge is dissipated.

Several misconceptions hamper an understanding of static dissipation. Some manufacturers or marketers of static dissipators are partly at fault for offering unnecessarily complex and confusing explanations of static dissipator operation, perhaps for marketing reasons. The April article is an example of the bitter fruit of that misguided information.

Many sophisticated companies are using static dissipators to protect their

Mobile Radio Technology

The journal of mobile communications technology

EDITORIAL

Don Bishop, *Editorial Director*
Jane Bryant, *Staff Editor*
Tom Cook, *Senior Managing Editor*
Kathy Mickelson, *Editorial Assistant*
James McWard, *Editorial Assistant*

ART

Kevin Callahan, *Creative Director*
Terri Blunt, *Graphic Designer*

INDUSTRY CONSULTANT

Fred M. Link

EDITORIAL ADVISORY BOARD

Gene A. Buzzi, *President, Omnicom Telecommunications Engineering, Tallahassee, FL*
R. James Evans, *Communications Consultant, East Lansing, MI*
Gary David Gray, *P.E., Chief Telecommunications Engineer, Orange County Communications, Orange, CA*
Frederick G. Griffin, *P.E., President, Frederick G. Griffin P.C., Lynchburg, VA*
Art McDole, *Director of Communications, Monterey County, CA*
F. Stuart Meyer, *Land Mobile Consultant, Vienna, VA*
Herb Sachs, *Herb Sachs Consulting, Bowie, MD*
Leon Spencer, *Radio Engineering Systems, Exxon Company USA, Houston, TX*

Dr. Gregory M. Stone, *Director of National Security and Public Safety, RJO Enterprises, Lanham, MD*
Kenton Sturdevant, *Frequency Coordinator, Forest Industries Telecommunications, Eugene, OR*
Raymond C. Trott, *President, Raymond C. Trott Consulting Engineers, Irving, TX*

BUSINESS

Cameron Bishop, *Group Vice President*
Eric Jacobson, *Publisher*
Mercy Contreras, *Associate Publisher/National Sales Manager*
Stephanie Hanaway, *Promotions Manager*
Kelly Hawthorne, *Promotions Coordinator*
Dee Unger, *Advertising Business Manager*
Liz Turner, *Advertising Coordinator*

ADMINISTRATION

R. J. Hancock, *President*
Doug Riemer, *Circulation Vice President*
Jo Ann DeSmet, *Circulation Fulfillment Manager*
Sandra J. Stewart, *Circulation Director*
Dee Manies, *Reader Correspondent*

ADVERTISING: Regional sales offices listed in classified section.

MOBILE RADIO TECHNOLOGY provides technical information to dealers, community repeater operators, specialized mobile radio operators, conventional RCC, WCC, cellular RCC, WCC, mobile radio equipment manufacturers, manufacturers' representatives, distributors, engineering, consulting firms, national government, military agencies, state/local government, public safety agencies, transportation companies, petro-

leum/energy products companies, public utilities and others allied to the field.

CORRESPONDENCE: Editorial, advertising and circulation correspondence should be addressed to P.O. Box 12901, Overland Park, KS 66212-0930, 913-888-4664, telex: 42-4156 INTERTEC OLPK, fax: 913-541-6697.

SUBSCRIPTIONS: MOBILE RADIO TECHNOLOGY is circulated without charge by name and title to personnel who are responsible for sales, operation or maintenance of mobile radio equipment. Non-qualified subscriptions in the United States are \$25 per year, in Canada and other countries, \$30 per year. Foreign airmail optional at an additional \$50 per year. Single copies are \$2 plus postage and handling; back issues, \$3 plus postage and handling. Adjustment necessitated by subscription termination at single copy rate. Allow six to eight weeks for change of address or for new subscription.

PHOTOCOPY RIGHTS: Permission to photocopy for internal or personal use is granted by Intertec Publishing Corporation for libraries and others registered with Copyright Clearance Center (CCC), provided the base fee of \$2 per copy of article is paid directly to CCC, 21 Congress St., Salem, MA 01980. Special requests should be addressed to Eric Jacobson, publisher.

\$2.00 + 0.00

VBPA ABP

Audited Circulation

INTERTEC
PUBLISHING CORPORATION

©1988. All rights reserved.

Eliminate Costly Trips to the Site!



Model #5200 Remotely Programmable Interconnect for shared systems where message accounting, or multifunction selective signaling make money for the system operator.

#3500 Remote Data Station brings call activity data to your office. Automatic message accounting data for interconnects, including LTR Rics, at your fingertips, not at the site!

The NEW 510SA-II provides for half-duplex, or simplex interconnection and includes a repeater controller. Remotely programmable, selective signaling, and remote base operation from any telephone.

Make The **RIGHT** Connection

CES

**Communications
Electronics
Specialties, Inc.**

931 South Semoran Blvd., Suite 218
Winter Park, Florida 32792
Telephone: 407/679-9440
Toll Free: 1-800-327-9956

*Call us for your copy of
The Telephone Interconnect Planning Guide*

CES manufactures a complete line of telephone interconnects, message accounting, remote data acquisition and control equipment; DTMF encoders, handsets, and microphones.

Letters to the editor

towers, buildings and other installations. These companies do not operate on a lark; they carefully analyze and justify their costs, based on experience. If they do not choose to publish the results of their experience, it does not follow that their experience is unfavorable or invalid.

The use of static dissipators does not obviate the need for other forms of lightning protection equipment. Static dissipators address one cause of lightning damage. Grounding, bonding and the use of various devices to suppress surges on electrical and data lines address other causes of lightning damage. The technologies are not mutually exclusive. Rather, they enjoy a symbiotic relationship.

When we at Lightning Master install a static dissipation system, we always recommend the use of effective grounding, bonding and surge suppression. We recognize that all available technologies must be used together to afford maximum protection from lightning damage.

By the way, it totally escapes me how

installing a static dissipator at or near the top of a tower or structure can change the grounding of that tower or structure.

We welcome serious, informed study of static dissipation for protection from lightning damage. We look forward to more articles and discussion on the subject and will be pleased to participate.

Bruce A. Kaiser
President
Lightning Master

Brooksville, FL

Our number one problem is getting FCC licensing for customers.

Donald Hutto
Advanced Electronics
Poplar Bluff, MO

Two of the toughest challenges in the industry are:

- Obtaining parts for mobiles that have been out of production for many years.
- The inability to know every radio

made: past, present and future.

Tim Tymchyshyn
Amtrak Communication
Regina, Saskatchewan

Your February 1988 issue is another fine edition of an exceptionally well-written and informative trade journal.

F.R. Vondra
Bennington Police Department
Bennington, NE

I enjoyed "Fast charging nicad batteries" by N. Hershkowitz and C.E. Forest in the March 1988 issue. I would like to see a diagram of the circuits used.

The biggest problem I have is getting customers licensed—NABER is a pain, even for simple business systems. Now you cannot obtain a license if the proposed site is within 1 mile of another user's site on the same frequency. There are not enough VHF frequencies to choose from.

Bruce Resteau
Bartronics
Valparaiso, IN

North American Office Now Open

SHINWA

COMMUNICATIONS OF AMERICA INC.

Carroll Hollingsworth, J.T. Summerlin and Toshi Mori are in charge of this new company. SHINWA Communication of America goals are to provide a more extensive product line and improve service with prompt delivery.

For information call:

SHINWA Communications of America Inc.
10 North Lee, P.O. Box 26407
Oklahoma City, OK 73126
405 232-7272 or FAX 405 236-8151



SINCLAIR

***Solving
radio
communications
problems
world-wide
for over
35 years.***

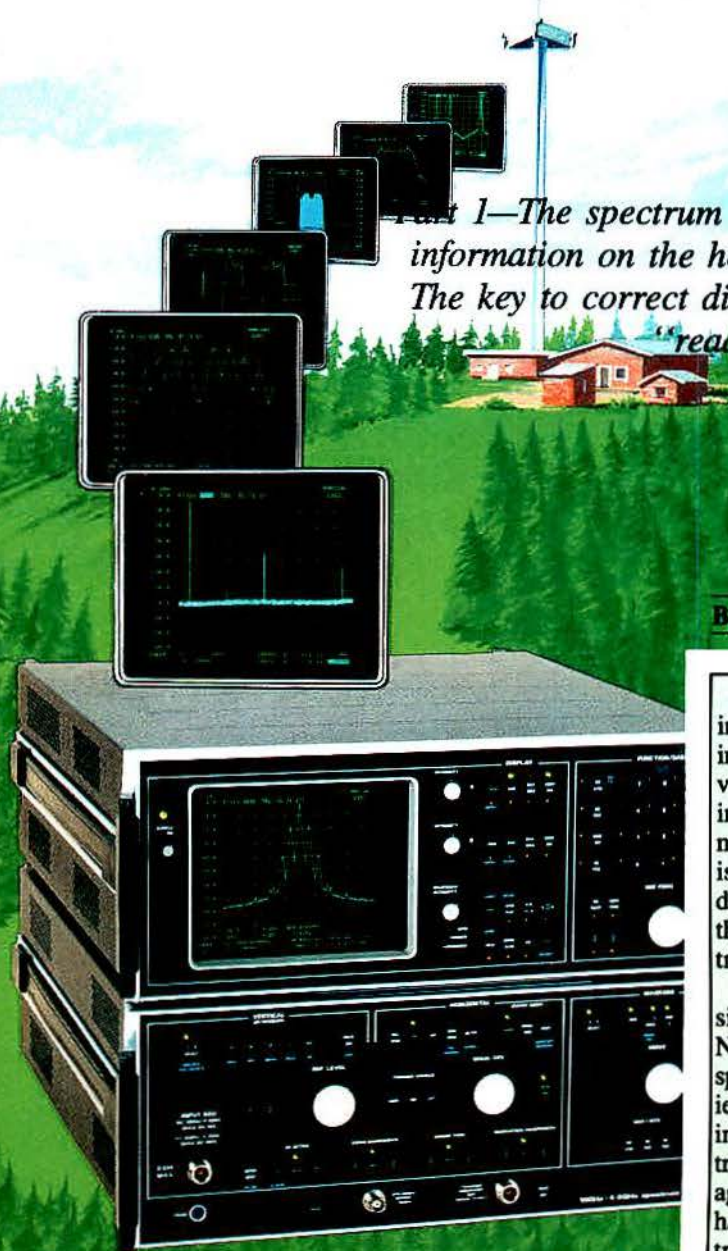
Sinclair Radio Laboratories Inc.

675 Ensminger Rd.,
Tonawanda, N.Y. 14150
(716) 874-3682

Visit us at Expo East, Booth #412-414.

Circle (9) on Rapid Facts Card

Using a spectrum analyzer in cell site service



Part 1—The spectrum analyzer can provide exacting information on the health of a cellsite transmitter. The key to correct diagnosis is in knowing how to "read the charts."

By Carl Pepple

The cellular telephone has made a big impression on mobile America. Keeping in touch has become as easy as activating the autodialer while maintaining 55mph on I-80. Simple though this may be for the user, cellular technology is amazingly complex, combining digital and RF technology in a system that provides enormous capabilities—transparently.

This complexity makes servicing cell site equipment a challenging task. Nevertheless, a good-quality portable spectrum analyzer can make the job easier—if the people using it are trained to interpret what they see. Diagnosis of transmitter performance differs from diagnosis of receiver performance. Each has unique requirements. We'll look at transmitter evaluation first.

Convention always has dictated that the vertical axis of a spectrum analyzer's CRT display will show amplitude, and its horizontal axis will show frequency. This frequency-domain presentation allows the user to glean more information about the characteristics of the signal from a one-dimensional display. For example, the amplitude of the signal's second and third harmonics may be seen on a spectrum analyzer but is not visible on an oscilloscope display. (See Figure 1 below.)

Although the spectrum analyzer is most frequently used to monitor a transmitter's output, it can make other measurements, too. For example, by either inserting a sampling Tee connector into the transmitter's output path or by terminating the transmitter into a proper load, the spectrum analyzer can characterize the "signature" of the output.

In the case of a cell site transmitter that produces FM, the unmodulated fundamental frequency (or the assigned channel frequency) should be a single signal on the display (Figure 2A on page 12). For a closer inspection, the technician can select a narrower scan width on the spectrum analyzer and zoom in close to the carrier. At this point, some unwanted signals may begin to appear. We will investigate transmitter output later.

FM deviation measurements

The spectrum analyzer is also well suited in making extremely accurate transmitter FM deviation measurements. This is accomplished using the Bessel zero (or null) method. The Bessel null is a special mathematical function that describes the relationship between spectral lines in frequency modulation. The Bessel null technique is so accurate that it forms the basis of modulation meter calibration.

The idea behind the Bessel null method is to drive the carrier spectral line to zero by changing the modulation frequency. When the carrier amplitude is zero, the modulation index is given by a Bessel function. Therefore, deviation

may be found by the following equation:

$$\text{Deviation frequency } (\Delta F_c) = \beta \times F_m$$

where β is the modulation index and F_m is the modulating frequency. The carrier frequency "disappears" at the Bessel null point, with all power remaining in the FM sidebands. (See Figure 2B on page 12.)

The cell site transmitter may be modulated with the 10kbps overhead message stream and the analyzer's demodulation function used to measure transmitter deviation and check the overhead message's pulse timing. A typical display for a versatile spectrum analyzer in this mode of operation illustrates this point. (See Figure 2C on page 12.)

Tracking generator

A tracking generator can be used in conjunction with the spectrum analyzer to check the dynamic response of frequency-sensitive devices such as transmitter isolators, cavities, ring combiners, duplexers and antenna systems.

A tracking generator is a frequency source that is "locked" in-step with the spectrum analyzer's CRT horizontal trace. The resulting display shows the relationship of the signal frequency and

amplitude of a device under test. This test setup now becomes a scalar analyzer system that can characterize the device under test. Some analyzers can even drive hard-copy plotters to provide a record of a measurement.

The dynamic range of the spectrum analyzer and tracking generator combination, as well as total level accuracy, is important. Cellular transmitter combiners and filters require analysis over operating ranges of at least 100dB, and insertion loss measurements of some devices will require resolution to tenths of a decibel.

Swept-frequency measurements

In addition to level accuracy, there are two categories of swept-frequency measurements that may be performed at the cell site—transmission measurements and reflection measurements. Each makes a meaningful contribution to overall performance evaluation.

Transmission measurements include:

- frequency response.
- insertion loss.
- attenuation.
- reflection.
- isolation.

Reflection measurements include:

- reflected power.
- VSWR.
- return loss.

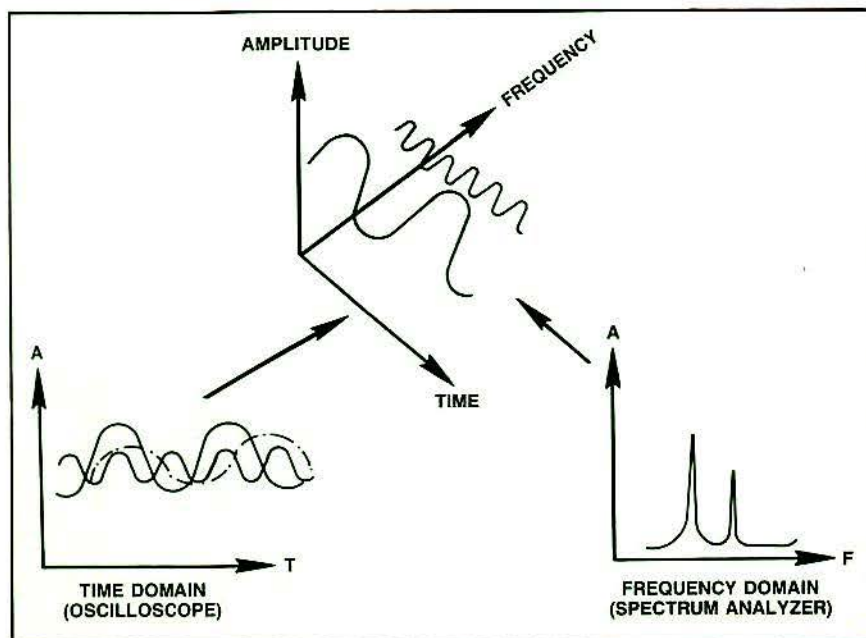


Figure 1. The presentation of information is different on a spectrum analyzer than on an oscilloscope. For example, the amplitude of the signal's second and third harmonics can be seen on a spectrum analyzer, but not on an oscilloscope.

They require a return-loss bridge or coupler.

To determine the bandpass characteristic curve for a single port of a ring combiner, all transmitters served by the combiner must be taken out of service and all ports other than the input and output ports under test should be terminated with a proper resistive load.

(See Figure 2D). The tracking generator output is fed to the input port while the spectrum analyzer input is connected to the ring combiner output port. Set the tuning adjustment for the cavity serving the port under test for peak response at the selected channel, and continue this process for all ports. Use the level-measurement capability of the spectrum

analyzer to verify that the cavities' 3dB (half-power) operating points meet the manufacturer's specification. A return-loss bridge may be inserted in the circuit after cavity alignment to ensure that the device is providing a proper 50Ω load to the transmitter. (See Figure 2E at the left.)

When the combiner and all transmitters it serves are returned to service, the spectrum analyzer can monitor the combined outputs delivered to the antenna system. Again, the level accuracy of the spectrum analyzer is important because output power must be verified. This test is performed on either an individual channel or on multiple channels, depending on the spectrum analyzer's resolution bandwidth setting. (See Figure 2F at the left.) For a quick in-service check, adjust the analyzer bandwidth to a wide mode and visually compare the peak level of all channels. "Hot" transmitters are revealed immediately.

Interpreting results

As with all measurements, care and the ability to interpret the results are key elements in making an accurate diagnosis of system performance. A rather simple example of this tricky task is the case of power supply ripple. (See Figure 3 on page 14.) It would be easy to become alarmed at a display like this—and it would be easy to conclude that the power supply is in some way faulty. But an identical display could be produced by spurious frequency modulation with a deviation of only 30Hz. The moral is—don't jump to conclusions, because there is no universal truth in making subjective judgments based on factual information.

Care must also be exercised to ensure that any distortion shown on the display is produced by the device under test and not the spectrum analyzer's input mixer. To reduce the possibility that internally generated distortion will occur, the input signal level to the analyzer's first mixer should be kept as low as possible. A good rule of thumb is to make sure the displayed signals do not exceed the top of the screen on the analyzer's display. If the analyzer's input attenuator cannot accomplish this, use a calibrated external attenuator in line with the analyzer input. Remember to factor the

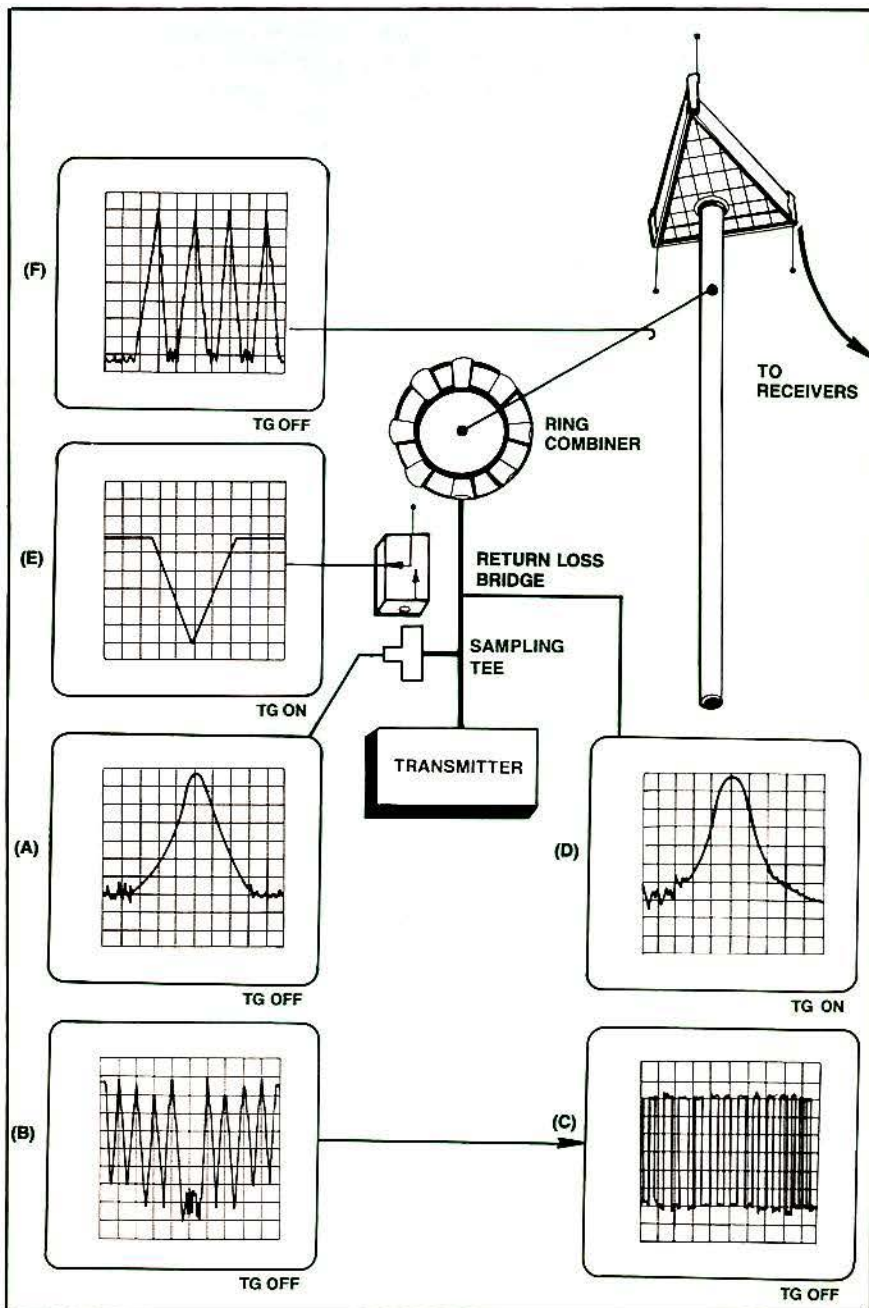


Figure 2. An unmodulated FM carrier is shown in (A). In (B), the carrier is nulled to zero. In (C), the overhead message stream is displayed. In (D), the passband characteristics of the combiner's input port are illustrated. In (E) return loss measurement using a bridge is shown, and (F) shows a typical display for monitoring combined output of several transmitters for proper output power.

THE BEST

THE CMR900 BEST THRU GLASS™
CELLULAR ANTENNA EVER MADE



- Tri-Linear Construction With Unique Surface Radiator
- 5dB Gain
- Elevated Feed Effect
- Unique Ground Plane Radials
- Field Tunable

Visit us at Expo East, Booths 251 & 253.

CELLULAR TECHNOLOGY™



20120 Plummer Street • Chatsworth, CA 91311
(818) 701-5848 EXT. 407

*Copyright 1988 Alliance Research Corporation

PATENT PENDING

Circle (10) on Fast Fact Card

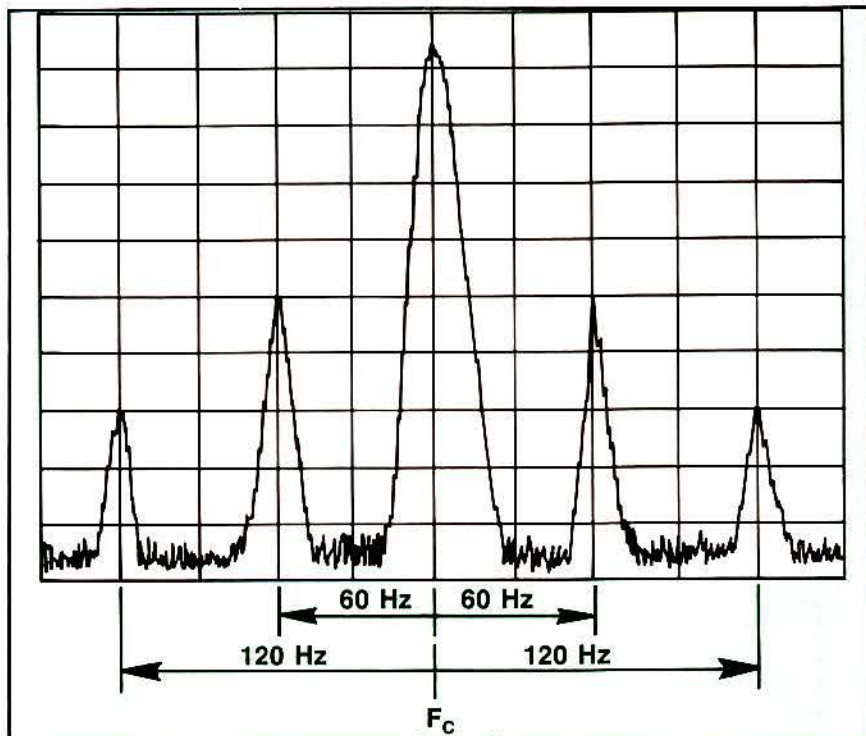


Figure 3. Is this power supply ripple (hum on the FM carrier) or spurious FM with a deviation of 30Hz? It could be either, and only a thorough examination of the transmitter will tell.

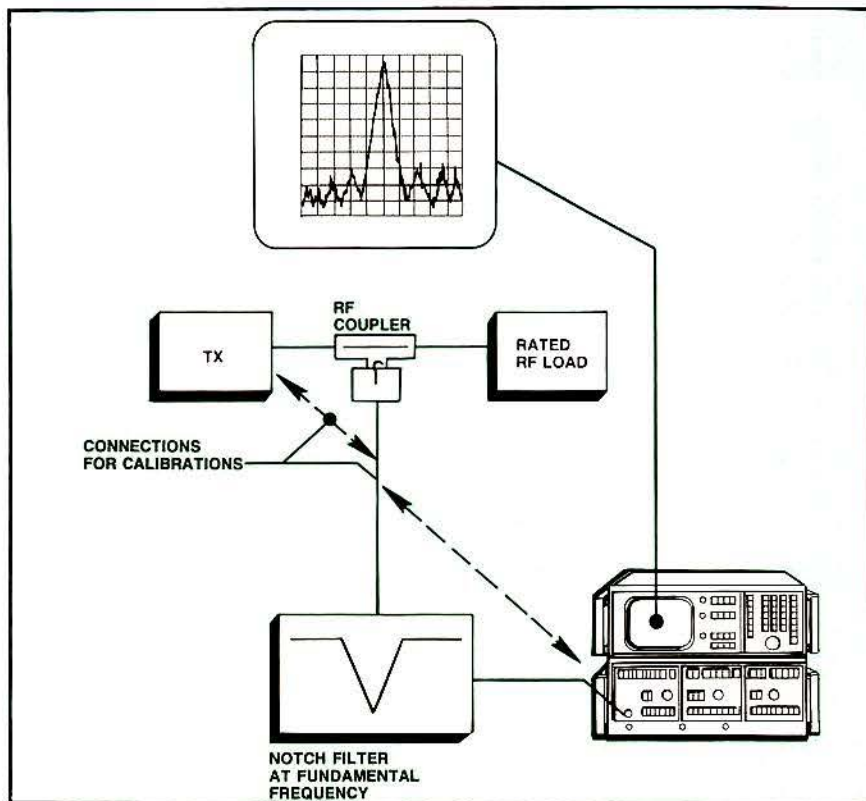


Figure 4. This test setup is all that is needed to measure harmonics and spurious output of the transmitter. A high-pass filter could be used to remove the fundamental frequency. Nevertheless, it also would attenuate other frequencies of interest.

loss of the external attenuators into the on-screen readings.

To further ensure that no distortion products are being generated in the analyzer, simply switch in 10dB of RF attenuation. The fundamental signal and all harmonics should drop 10dB on the screen. If the harmonics drop by more than 10dB, the analyzer is producing some or perhaps all of the distortion.

FCC compliance

The spectrum analyzer is also an excellent tool for verifying whether second and third harmonic output and spurious output levels comply with FCC requirements. The analyzer must have frequency coverage to at least 2.8GHz as well as a resolution bandwidth that allows close inspection of the signals. The test setup needed to measure harmonics and spurs is illustrated in Figure 4 below. The notch filter suppresses the carrier frequency. If the carrier is not removed from the measurement, the high-power output of the transmitter will overdrive the spectrum analyzer input and create intermodulation products within it. As a result, the analyzer will display false signals.

The advantage of a notch filter over the alternate approach of using a high-pass filter is that spurs close to the carrier frequency can be measured. Spectrum analyzers such as the Marconi model 2383 have resolution bandwidths down to 3Hz at 4.2GHz.

FCC regulations require that harmonics or spurious output be attenuated 43dB +10log of the power output expressed in watts. When performing this test, make sure the transmitter is connected to a suitable RF (resistive) load with a proper continuous-duty power dissipation rating. A good-quality spectrum analyzer will further allow the user to investigate various potential problem sources, such as the transmitter's basic crystal frequency (typically 18MHz to 22MHz) appearing as a spur of the transmitter's second harmonic, or power-line harmonics combining with the fundamental carrier to produce spurious outputs. Although the spurs may not impair cellular system performance, they may interfere with other services.

In Part 2 of this series, we will describe how measurements of receiver performance are handled extremely well with a spectrum analyzer.

ICOM

IC-H18/U18



IN A HOSTILE WORLD YOU NEED RADIOS THIS TOUGH

MIL STANDARD. ICOM introduces a new generation of harder working two-way radios built to meet the rigors of the most hostile environments.

The IC-H18 VHF and IC-U18 UHF portables meet or exceed U.S. Government Military Standards 810C and 810D, plus they're built to intrinsically safe standards.*

BUILT TOUGHER. The IC-H18 and IC-U18 are designed to surpass the most physically demanding conditions. Built to exceed rigorous quality control tests. Rugged, dependable communications built for a hostile world. Utilizing the most sophisticated production tools available. . . robotic assembly, top quality components and superior engineering.

THE ICOM ADVANTAGE. A tough radio that's easy to operate . . . because in an emergency, there isn't time to worry about your communications system. Just talk.



IC-H18/U18

VERSATILE. ICOM has included 16 programmable channels easily selected by a rotary channel selector on the top panel.

Individual CTCSS receive and transmit tones can be programmed into each memory. Cloning capability to transfer data to a fleet of radios. Five watts power output with a low setting of 1.5 watts. Three scanning systems including a 50 channel per second scanning function.

An optional DTMF unit. Features that add up to a tougher handheld...the ICOM IC-H18/U18.



ICOM

HARD WORKING RADIOS

Circle (11) on Fast Fact Card

ICOM America, Inc., 2380-116th Ave. N.E., Bellevue, WA 98004 Customer Service Hotline (206) 454-7619
3150 Premier Drive, Suite 126, Irving, TX 75063 / 1777 Phoenix Parkway, Suite 201, Atlanta, GA 30349
ICOM CANADA, A Division of ICOM America, Inc., 3071 - #5 Road, Unit 9, Richmond, B.C. V6X 2T4 Canada
All stated specifications are subject to change without notice or obligation. *Pending Factory Mutual approval. U18H1858-2.

Getting the most from digital multimeters

Part 1—Use a digital multimeter to trace a short circuit on a printed circuit supply rail quickly. Make your own RF probe to measure dc voltages without loading the oscillator and affecting the reading.

By William L. Detwiler

A short circuit on a supply rail in a radio does not happen often, but when it does, it can be a real problem. Typically, the rail runs all around the circuit

board, connecting to many bypass capacitors and to shielded cans, transformer windings and other components.

A traditional way of finding the problem is to "divide and conquer": Cut the printed circuit at strategic spots until you isolate the short. With this method, by

the time you find the short, the set has become a disaster. Instead of the short, the biggest problem is putting the circuit board back together.

Tracing short circuits is a common problem with digital boards—not only on the supply lead, but on buses that connect to multiple integrated circuits (ICs).

The digital multimeter traces these short circuits easily, without cutting the printed circuits. Here is an example of how to use a multimeter to trace a short circuit on the positive power lead in a portable transceiver:

- Solder a short piece of bus wire to almost any location along the shorted bus. The preferred position is near the center of its length. (See Photo 1 at the left.)

- Connect a power source that supplies about 0.5A current through the bus wire and, thus, through the short, as shown in Photo 2 on page 18. The source could be a power supply with a feature that limits current (as shown) or it could be a single C-cell battery in series with a 3Ω resistor.

Figure 1 on page 20 shows a simplified schematic that represents steps to take in placing multimeter probes onto the board to find the short. Although the printed circuit trace has extremely low resistance, only a few thousandths of an ohm per inch, a 0.5A current causes a voltage drop of a few millivolts per inch. A multimeter set to its most sensitive scale shows this drop easily. Use the probes to find portions of the trace with a voltage drop and portions with no drop.

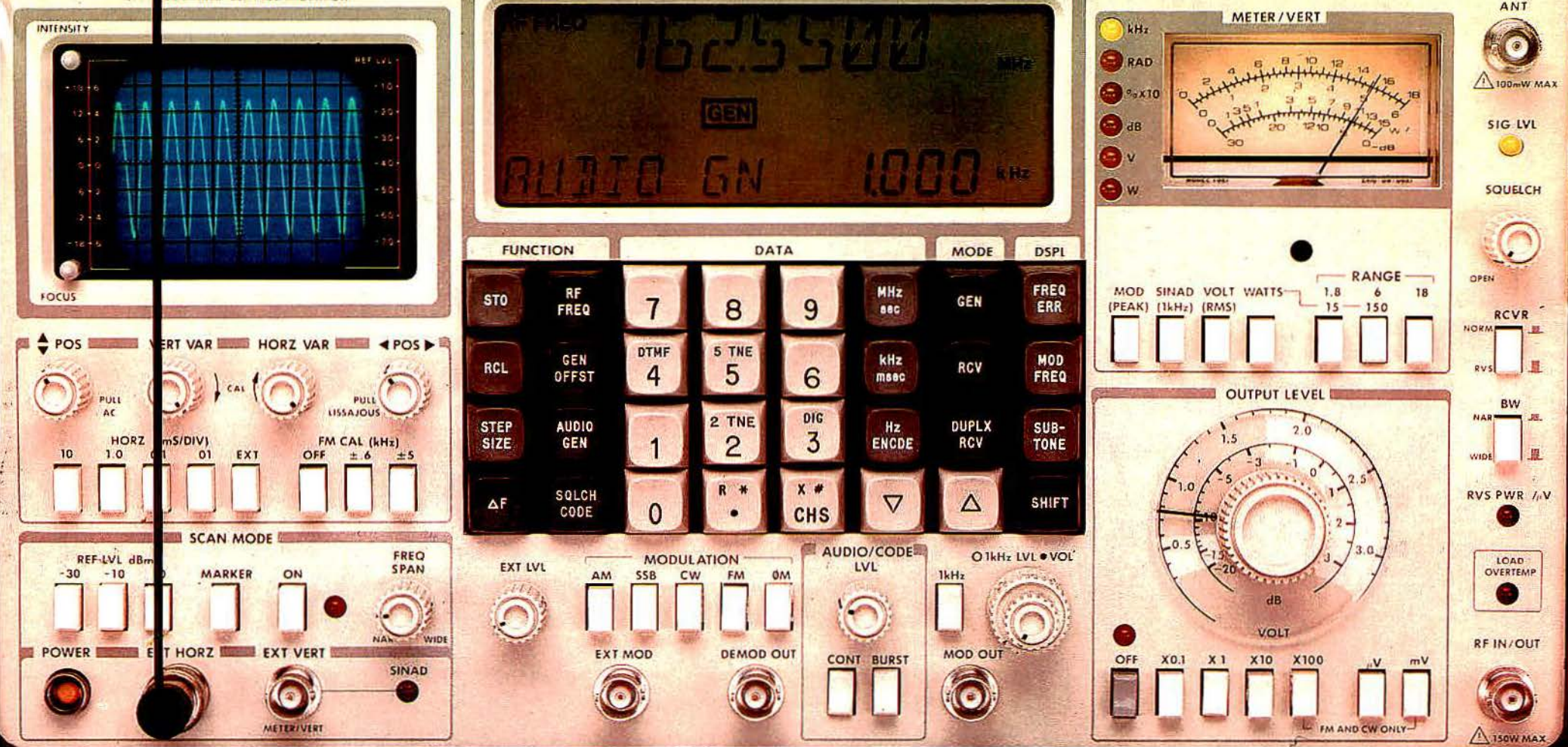
Set the multimeter to its lowest dc



Photo 1. Prepare the radio for finding a short circuit on the supply rail by soldering a short piece of bus wire to almost any location along the shorted bus. The preferred position is near the center of its length. For convenience in applying power to the circuit, another short piece of bus wire may be soldered to the ground rail.

Detwiler is president of Helper Instruments, Inc., Indiantown, FL.

CT SYSTEMS, INC. 5100S
0.4-1000 MHz SERVICE MONITOR



What's Wrong With This Picture?

Model 5100
Service Monitor
\$8495

The answer to this question
is on page 87.

- Spectrum Analyzer
- True Full Duplex/Offset Generator
- Tone and Digital Encoder/Decoder
- Storage and Recall Registers
- Built-In Self Diagnostics
- Full Sized Computer Style Keyboard

CT SYSTEMS, INC.
5245 HORNET AVE.
P.O. BOX 470
BEECH GROVE, IN 46107-0470
800-245-6356
317-787-5721

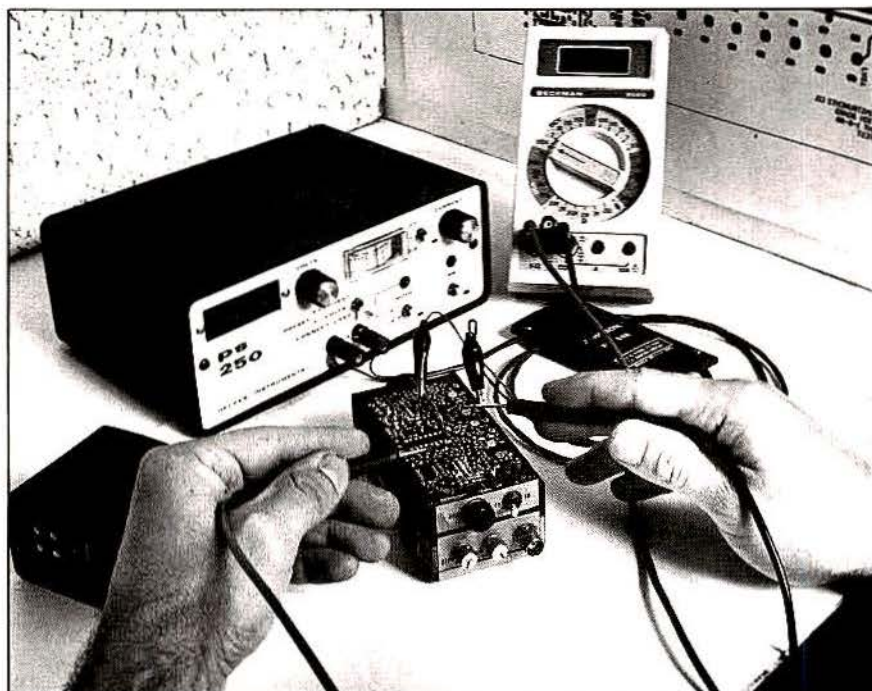


Photo 2. Connect a power source that supplies about 0.5A current through the bus wire and, thus, through the short. The source could be a power supply with a feature that limits current (as shown) or it could be a single C-cell battery in series with a 3 Ω resistor.

scale and check for voltage drops along the "plus" circuit trace. Unless you were unfortunate enough to solder the short piece of bus wire exactly at the location of the short, you will find a much larger voltage drop on one side of the bus wire connection than on the other.

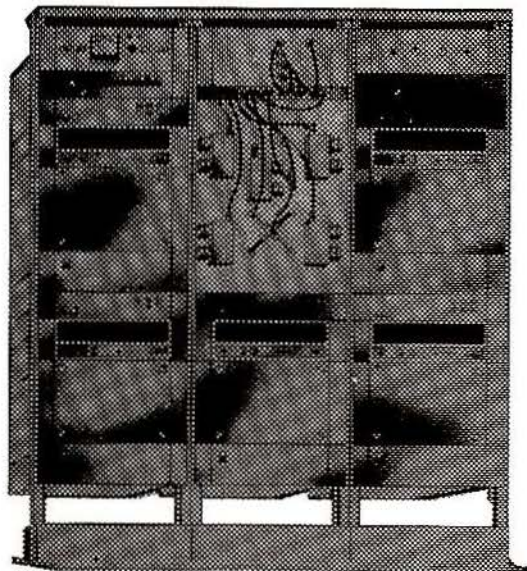
Follow the trace that shows the larger voltage drop, moving the probes a fraction of an inch at a time. As you approach the short, and each time you move the probes along the trace and away from the starting point, the multimeter will show a voltage drop. When you have moved the probes to the location of the short, the meter will read no voltage drop. You have found the short!

VTVM becomes multimeter

You can make your own multimeter probe accessory to measure dc voltages in RF circuits without loading the circuit and affecting the reading.

The multimeter's predecessor, the vacuum tube voltmeter (VTVM), used to come with such an accessory probe.

FAST



THE TOTAL TRUNKING SYSTEM FROM **uniden**[®] CORPORATION

THE ULTIMATE IN 800MHz POWER AND
FLEXIBILITY FROM UNIDEN CORPORATION.

EXCLUSIVE DISTRIBUTORS FOR CENTRAL,
SOUTH AMERICA AND THE CARIBBEAN.

WRITE OR CALL

For Brochures and Information:

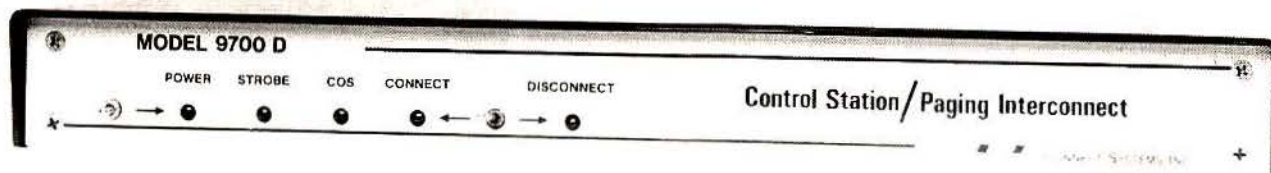
Beam Radio, Inc.

7851 N.W. 15 ST. MIAMI, FL 33126
TEL. (305) 477-2326
FAX 477-6351 TELEX 75-2901

From Factories to Fire Departments... Our 9700 is the *Complete* Communications Terminal for your simplex base...

Imagine initiating dispatch/talk back paging from
any phone. *AND* initiating paging/phone calls
from any mobile.

No other "DAPT" offers so much...
for so little!



FROM ANY PHONE IN THE PLANT

- Direct voice dispatching
- Dial access paging
- Talk back paging
- Selective calling
- Activate horn honkers
- Eavesdrop the channel
- Ringout calls to mobiles

FROM THE MOBILE OR PORTABLE

- Initiate phone calls
- Initiate paging
- Selectively call other mobiles/portables

SIGNALLING FORMATS

- Regenerated DTMF (std)
- Two tone sequential*
(1000 call capacity)
- CTCSS*
(32 call capacity)

AUTOMATIC SELF CONTROL FEATURES

- Automatic disconnect if number dialed is busy
- Automatic disconnect on unwanted dial tone
and other call progress tones.
- 30 second activity timer
- Timeout timer

* Optional

The 9700 can be connected to *any* simplex base station radio and used straight simplex or through any conventional or trunked repeater system. An optional electronic voice delay board completely eliminates word or syllable loss when used with slow switching radios or repeaters. Dip switch selectable pulse or fully regenerated tone dialout completely eliminates misdials which are common to other patches. Other important features include... CW identification, * up # down or multi-digit, toll protection, secret toll override code, ringout/auto answer on 1-8 incoming ring, lightning protection, desk top or rack mounted versions.

Additional features are too numerous to list. Call or write for your four page brochure **today**.

- ✓ 60 day return privilege
- ✓ One year warranty

The 9700 is the best performing simplex terminal in the industry!



CONNECT SYSTEMS INC.

23731 Madison St. Torrance CA 90505
Phone (213) 373-6803

IN CANADA:
CARTEL ELECTRONIC DISTRIBUTORS
(800) 663-0070

INTERNATIONAL SALES:
JESCOM COMMUNICATIONS
INTERNATIONAL, INC.

Phone: (415) 574-1421 TELEX: 278367 JSCM UR

CSI is a registered trademark of Connect Systems Inc.

Circle (14) on Fast Fact Card

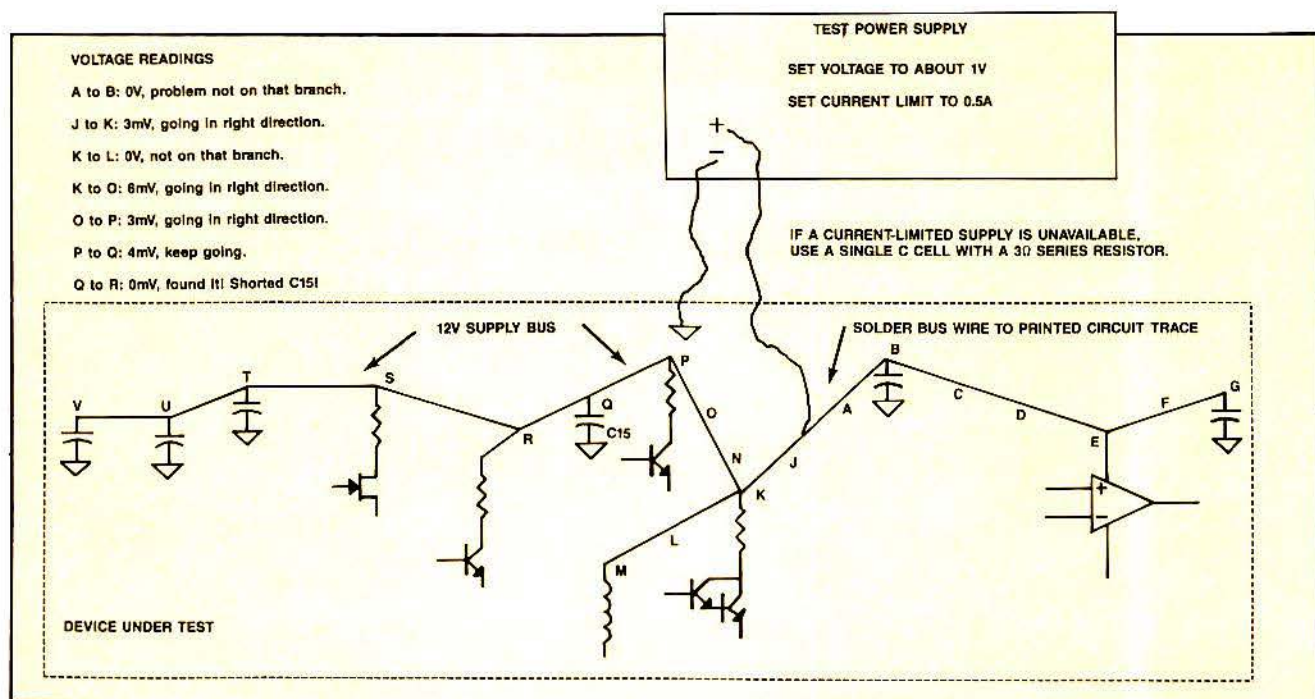


Figure 1. A simplified schematic shows steps to take in placing multimeter probes onto the board to find the short. Although the printed circuit trace has extremely low resistance, only a few thousandths of an ohm per inch, a 0.5A current causes a

voltage drop of a few millivolts per inch. A multimeter set to its most sensitive scale shows this drop easily. Use the probes to find portions of the trace with a voltage drop and portions with no drop.

Aerotron ACSB® Technology

The Communication Systems Problem Solver!



Aerotron's Full Line of ACSB® Radio Products Provide

- | | |
|--|---|
| <input checked="" type="checkbox"/> Clear Channel usage with no congestion | <input checked="" type="checkbox"/> Communication privacy |
| <input checked="" type="checkbox"/> Superior voice clarity in fringe areas | <input checked="" type="checkbox"/> Increased coverage area |
| <input checked="" type="checkbox"/> Narrowband modulation uses only 3.5 kHz BW | <input checked="" type="checkbox"/> Data compatible up to 4800 B.P.S. |

Contact Aerotron today and investigate the many advantages that the new narrowband 5 kHz VHF channels provide.

AEROTRON

A UNIT OF GENERAL SIGNAL

U.S. Highway 1 North P.O. Box 27500 Raleigh, N.C. 27611 (919) 872-4400 Telex: 579301



Circle (15) on Fast Fact Card



Will your radio communications system let you take control of an emergency?

When every second counts, your ability to control and coordinate emergency teams could keep a disaster from becoming a catastrophe.

Unfortunately, few of the radio systems in use today provide the inter-agency communication and overall control you need to launch a coordinated response.

Now GE brings you 16^{PLUS}™, the digitally trunked radio system that lets you tie all of your public safety and public service resources together into an efficient, coordinated response team.

Respond to emergencies quickly and without confusion.

With the 16^{PLUS} system, you can coordinate, regroup, and control your resources—from a central command point when necessary. Police, fire, and other emergency teams work *together*, and you stay in command of the situation.

Improve every-day communications.

The 16^{PLUS} system's digital trunking technology increases the capacity of your radio network. So you can satisfy the communications requirements of *all* your essential services—with the radio privacy and autonomy each needs to function efficiently.

Choose the system that gives you a choice.

The 16^{PLUS} system is a total communications system, offering you a complete spectrum of equipment.

Everything you need is available directly from GE. But we don't lock you into a sole-source relationship. Our philosophy is to give you access to the newest and best developments—from GE and from other vendors.

The choice is *yours*.

Call GE for more.

Learn more about the radio system that gives you the integrated communications to take command in emergencies. Call us toll free at 1-800-GE-12345.



GE Mobile Communications

General Electric Company
Lynchburg, Virginia 24502

Circle (16) on Fast Fact Card

TRACING A SHORT CIRCUIT

To use a multimeter to trace a short circuit on the positive power lead in a portable transceiver:

Solder a short piece of bus wire to almost any location along the shorted bus. The preferred position is near the center of its length.

Connect a power source that supplies about 0.5A current through the bus wire and, thus, through the short. The source could be a power supply with a feature that limits current or it could be a single C-cell battery in series with a 3Ω resistor.

Some technicians still use the name, VTVM, to refer to a multimeter, although vacuum tubes have not been used by multimeter manufacturers for many years.

Today's multimeters have one thing in common with the old VTVM: extremely high impedance for measuring dc voltages. It is not uncommon to find multimeters with an input impedance on the order of 20 megohms. What does that mean to the technician? The multimeter will not load the circuit being measured, as a simple voltmeter would. For all practical purposes, $20M\Omega$ is such a high input impedance that voltage readings taken with the multimeter are reliable.

But that does not mean you can measure *all* of the important voltages in a

Factory Prices On



2-WAY RADIO

MCS — MVS — MPI
PLS — PSX200
MLS — TMX
PHOENIX — TPX
MOST MODELS IN STOCK
FOR IMMEDIATE DELIVERY



800-233-2365 PA 800-482-2377
DEALER INQUIRY ONLY

Syntonic

7611 DERRY ST. HARRISBURG, PA 17111

Today's multimeters have extremely high impedance for measuring dc voltages.

radio with a digital multimeter (or an analog multimeter). When they stopped building VTVMs, almost all of the manufacturers who began building solid-state multimeters left out an important item: a $1M\Omega$ resistor at the end of the probe.

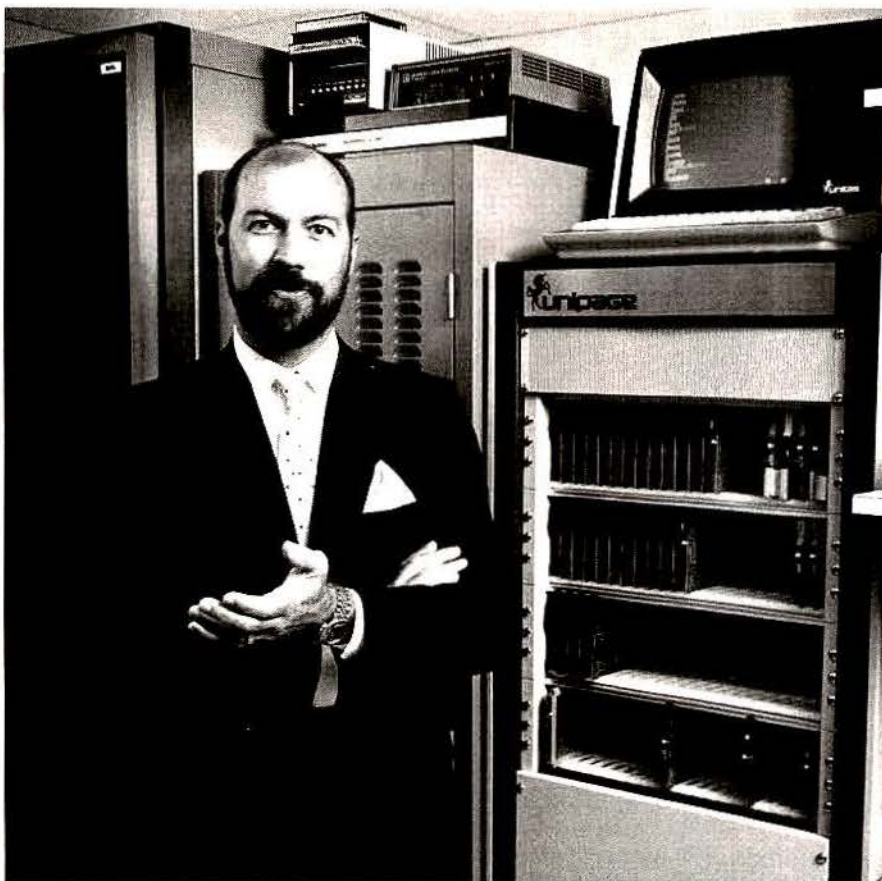
The resistor is important if the meter is used to measure voltage where RF is present. For example, if you use ordinary probes to measure voltage at the base of an oscillator, the capacitance of the leads usually kills the oscillation and the base voltage drops to the non-oscillating value.

Something similar happens when you place the probe on any of the RF or IF amplifier stages: The capacitance of the probe loads down the RF and usually upsets the dc value you set out to measure.

The cure is simple. Wrap one end of



unipage: Alert To The Situation.



Jeff Owens Vice-President Engineering, ProNet Inc., shown here with Unipage System 80.

With over 50,000 medical related subscribers depending on ProNet, Inc. to provide uninterrupted paging service Jeff Owens had to be certain he was making the right play. Jeff called on Unipage to carry the ball and on super bowl day 1988 the System 80 was installed in Dallas Texas . . . no fumbles-no missed pages. The final score was victory all around.

In the search for terminal alternatives Jeff was concerned about true expansion capability of the terminal he selected. Expressing his opinion on Unipage . . . "They are continually able to integrate new features with their technology, and, do it as part of the original design process. That is important when you are looking at a new product . . . any time you want to expand, you don't have to add a 'black box' on to make it work."

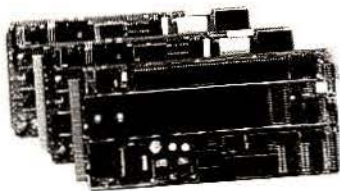
When asked how he viewed the Unipage terminal when comparing it to the others he evaluated, Jeff remarked . . . "In relationship to cost, there is no question that feature for feature and dollar for dollar Unipage stacks up number one."

On service, support, and engineering Jeff had to say . . . "it is really an asset to have a group of system engineers and technicians that will sit down with you . . . they are willing to work with you in solving your problems . . . Unipage is willing to do that."

The single reason ProNet decided on the Unipage terminal over all the others available . . . "ProNet provides high reliability communication services to the medical community. We went to the market place

initially seeking improvement for the processing of priority pages. The Unipage System 80 addressed our priority requirement and improved system thru-put. In addition, we got a redundant terminal system all for the same dollars others wanted for priority alone. The decision to go with Unipage just made good sense."

"I would recommend this paging terminal to ANYONE that is looking for a reliable system."



Modular design for unlimited growth.

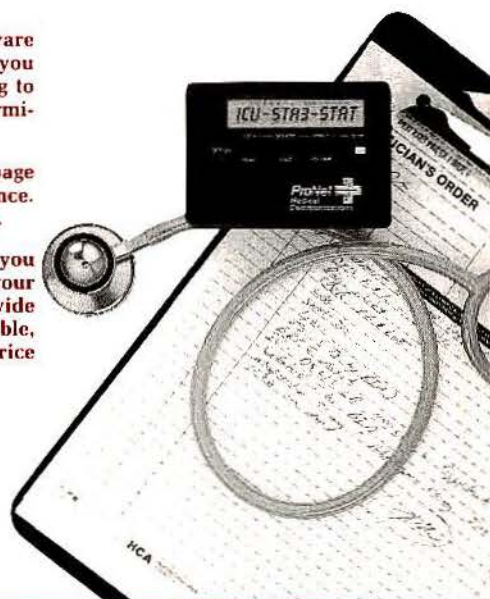
Unipage . . . a full featured . . . software driven terminal with all the features you want. From alpha paging to networking to all signalling formats Unipage is the terminal of choice.

Develop a championship team . . . Unipage and you . . . don't leave anything to chance. Call or write for a capability evaluation.

Whether you are just getting started or you are looking for a competitive edge in your market, Unipage paging terminals provide the most advanced technology available, long term growth and expansion and a price that you can afford.

THE STORY IS JUST BEGINNING . . .

UNIPAGE, INC.
1509 Falcon St. • Suite 101
DeSoto Tx 75115
1-800-367-2684 or (214) 224-3509



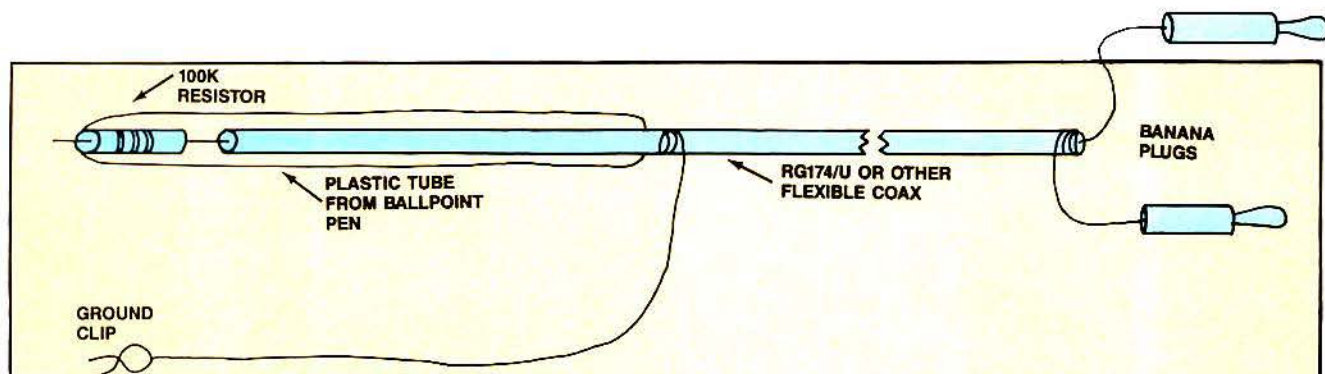
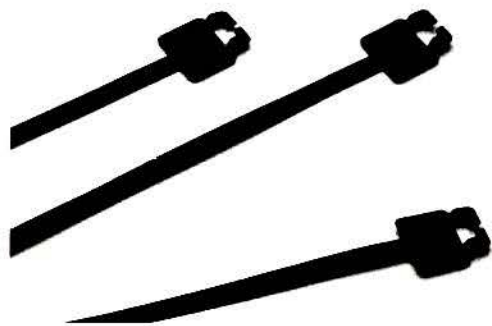
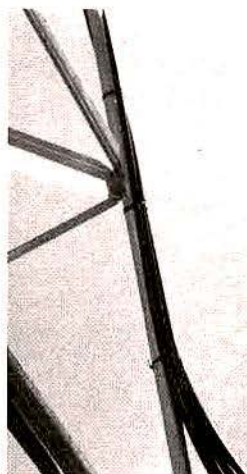


Figure 2. Make your own test leads for taking voltage measurements on RF circuits. The parts you will need are a piece of plastic tubing, some RG188/U and two plugs that fit your multimeter.



BAND-IT® E.V.A. Cable Ties

**For cable bundling on
communications towers and antennas**



Eliminate expensive maintenance costs associated with replacement of plastic cable ties. Begin using Band-It® E.V.A. Cable Ties, specifically designed for outdoor use on towers and antennas.

Plastic ties become brittle, crack, and often fall off due to U.V. breakdown, cold temperatures, and other outdoor weathering problems. Band-It® E.V.A. Cable Ties provide **permanent** protection from all outdoor conditions because they are made from high strength, corrosion resistant 316 stainless steel coated with Ethylene-Vinyl Alcohol * copolymer.

E.V.A. is U.V. resistant, flexible in extreme cold, corrosion resistant, flame retardant, non-toxic, halogen free, and protects cables from potential damage or interference due to direct contact with the stainless steel.

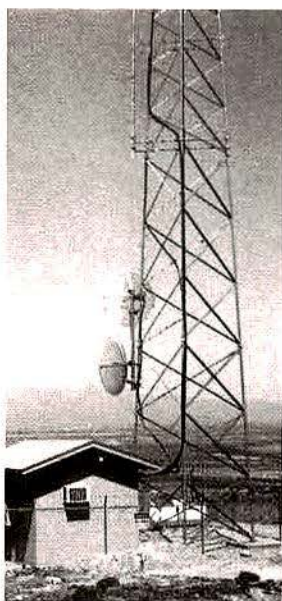
Band-It® E.V.A. Cable Ties are available in 1/4" and 3/8" widths, and lengths from 6" to 36". They are fast and easy to install and are **REUSEABLE**.

Write or call for your free sample and brochure, and the name of the Band-It® distributor nearest you.

* (Trade name Levasint®, mfg'd by Bayer, W. Germany)

BAND-IT®

BAND-IT — IDEX, INC.
A Unit of IDEX Corporation
P.O. Box 16307
Denver, Colorado 80216-0307 U.S.A.
Ph: 303-320-4555 Telex 45-0009
FAX 303-333-6549
Cable BANDIT



a resistor around the test probe tip and use the other end to connect to the sensitive circuit location. A resistor as small as 100,000Ω will avoid the loading effect. One as large as 1MΩ would only give you a 5% error with the typical 20MΩ input impedance found in today's test instruments. The 100,000Ω resistor is a good choice; the error it introduces is only 1/2 of 1%, a negligible value for any service measurement.

Custom test lead

You can make your own test leads for making measurements on RF circuits. The parts you will need are a piece of plastic tubing, some RG188/U and two plugs that fit your multimeter (Figure 2 above).

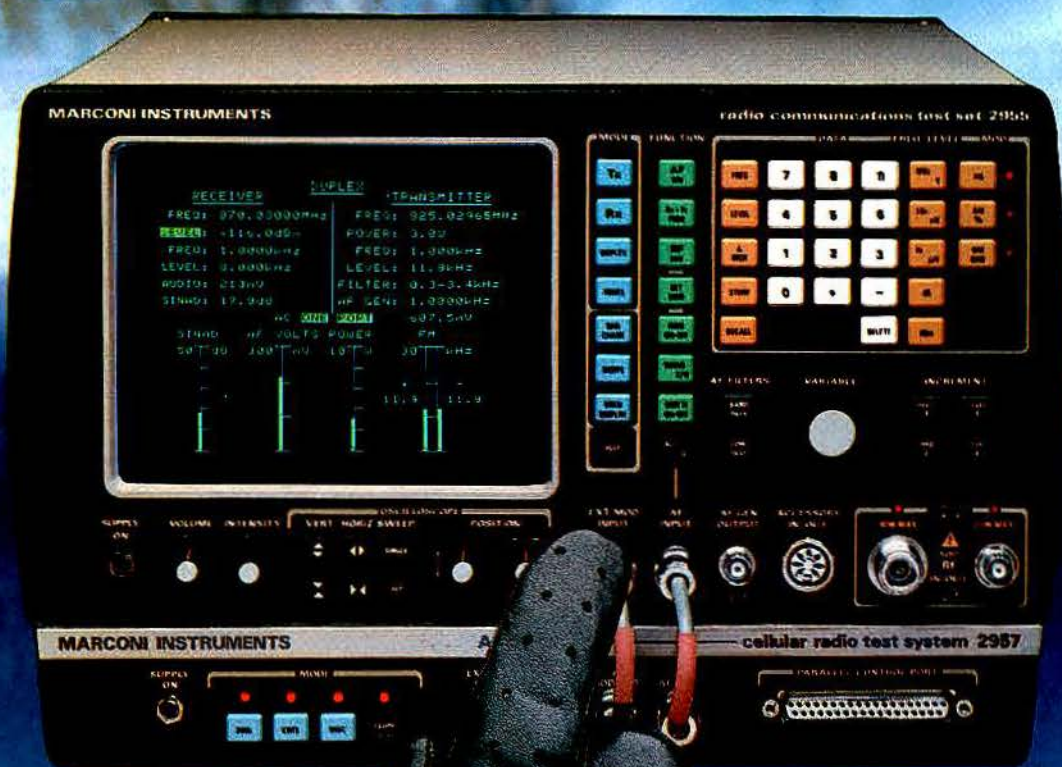
The handcrafted test lead is even better than the ones formerly provided with VTVMs. The VTVM lead usually came with a rather large pin holder assembly at the end. The assembly probably added one or more picofarads of capacitance. The custom test lead avoids additional capacitance because the resistor lead serves as the probe tip, and it is clipped so it is only about 1/8-inch long. The loading capacitance is truly tiny—small enough to create little detuning on the most sensitive circuits.

The resistor lead wears down after repeated use. But resistors cost less than 1 cent, so the operating expense on the probe really is quite reasonable.

A future article will explain how to use the digital multimeter to test diodes and transistors, as well as a powerful troubleshooting technique that uses the diode test in conjunction with the meter's ohmmeter function.



FOR SPEED AND SIMPLICITY IN CELLULAR TELEPHONE TESTING...



Marconi's 2957 Cellular Radio Test Set drives you to the finish line while others are warming up their equipment.

Just press a single button and immediately know if the radio passes or fails. If in-depth tests are required, the powerful duplex display of the Model 2957 allows monitoring of key transmitter and receiver measurements simultaneously. Now you can perform fault analysis or adjust the radio to meet EIA or carrier specifications.

Marconi
Instruments

All this plus...

- Full cell-site simulation • Parallel/serial/IEEE printer output ports
- Non-volatile storage of local operational parameters • Full line of accessories available including: audio break-out box, disk drive for storing custom test routines and more.

Cross the winner's line to efficiency. Call or write for literature or a demo.

Marconi Instruments,
3 Pearl Court, Allendale, NJ 07401,
1-800-233-2955 • (201) 934-9050



ACSSB advancements improve data transmission

Synchronous transmit-receive control eliminates received-signal offset and virtually eliminates phase and amplitude effects of multipath fading. The result: higher data speeds with less error-correction overhead.

By Douglas P. Collette

With the advent of the microprocessor, modern digital control systems are providing a level of performance and sophistication that was only a dream 10 or 20 years ago. Supervisory control and data acquisition (SCADA) systems control and monitor a vast array of functions at hundreds of locations, saving untold time, manpower and money.

One obstacle to SCADA system implementation is the requirement that a data communications net-

work transfer data between the central station and remote sites, primarily either by wireline or radio. Wireline historically has been the more popular of the two, but that is changing rapidly today. Since AT&T divested its operating companies, monthly tariffs on leased wirelines have increased from fourfold to tenfold in many areas, causing an unprecedented number of data communications users to abandon leased wirelines in favor of radio telemetry. The payback period for conversion from wireline to radio can be as short as one to two years.

For radio communications and telemetry systems, frequency modulation (FM) is by far the most popular

modulation technique, and for good reason. FM equipment is relatively inexpensive, provides excellent voice and data quality and is widely available from a multitude of manufacturers. But FM also has its drawbacks, mainly, the relatively large amount of RF bandwidth required for a given audio bandwidth and the adverse effects of multipath fading on digital data.

Today's FM radio equipment typically requires 16kHz of RF bandwidth for an audio bandwidth of 3kHz. If radio spectrum were unlimited, the fivefold increase in RF bandwidth would not be a problem. Unfortunately, radio spectrum is a limited resource, and we nearly have used it up in this country.

Radio channels in most major cities may have 100 or more users per channel, and this number grows daily. The private radio community has used VHF lowband and highband widely for many years because of the propagation quality. As VHF frequencies became saturated, users began moving into the UHF band. Eventually the FCC began allocating UHF TV channels for land mobile use. The latest allocation is in the 800MHz to 900MHz band. Unfortunately, as a general rule of thumb, as the frequency goes up, the price goes up, and the range goes down. At frequencies in the 800MHz band, foliage and terrain can limit the operating range severely.

In a mobile environment, multipath (Rayleigh) fading can affect data adversely, even in strong signal areas. Every time the vehicle drives

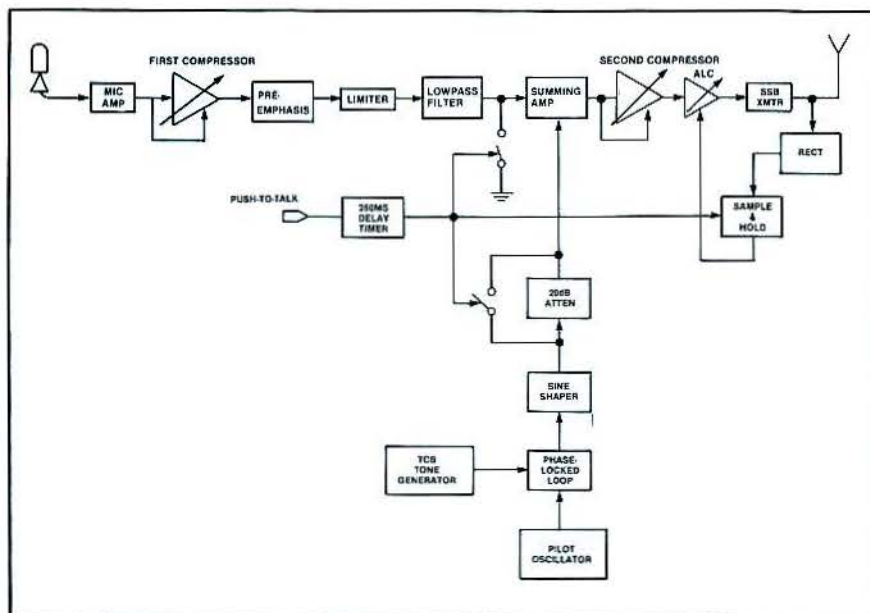


Figure 1. ACSSB transmitter block diagram. Current radio models use pilot tone at 3,100Hz and an audio passband from 300Hz to 2,500Hz.



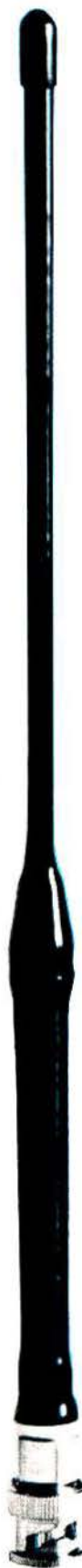
Larsen comes through when the heat is on.

Disaster can strike at any place, any time. And when it does, the need to communicate quickly and clearly becomes critical.

That's when you should call on Larsen.

Larsen offers a full line of antennas ideally suited for portable, mobile and base station applications.

No matter what your system margins or performance requirements happen to be, it's Larsen to the rescue.



YOUR SYSTEM SOLUTION.

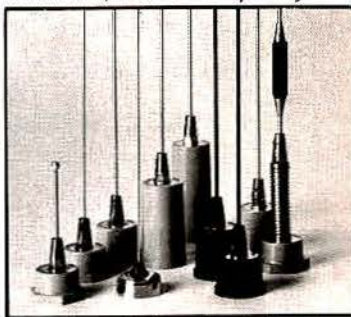
Whether your system requirements include high gain, high bandwidth, no ground plane, on-glass, thick mounting, tough environment, or even temporary installation,

Larsen has the solution.

From 25 to 1200 MHz, Larsen delivers

high performance with just the right mix of durability and ease-of-installation to meet your system requirements.

Larsen is your system solution.



Circle (20) on Fast Fact Card



Larsen Antennas

IN USA: Larsen Electronics, Inc., 11611 N.E. 50th Ave. P.O. Box 1799, Vancouver, WA 98668. 206-573-2722. Toll Free order line: 1-800-426-1656. In Washington State 1-800-562-1747. Telex: 15-2813 LARSENELC VANC

IN CANADA: Canadian Larsen Electronics, Ltd., 149 West 6th Avenue, Vancouver, B.C. V5Y 1K3. 604-872-8517. Toll Free 1-800-663-6734. Telex: 04-54666 CDN LARSEN VCR

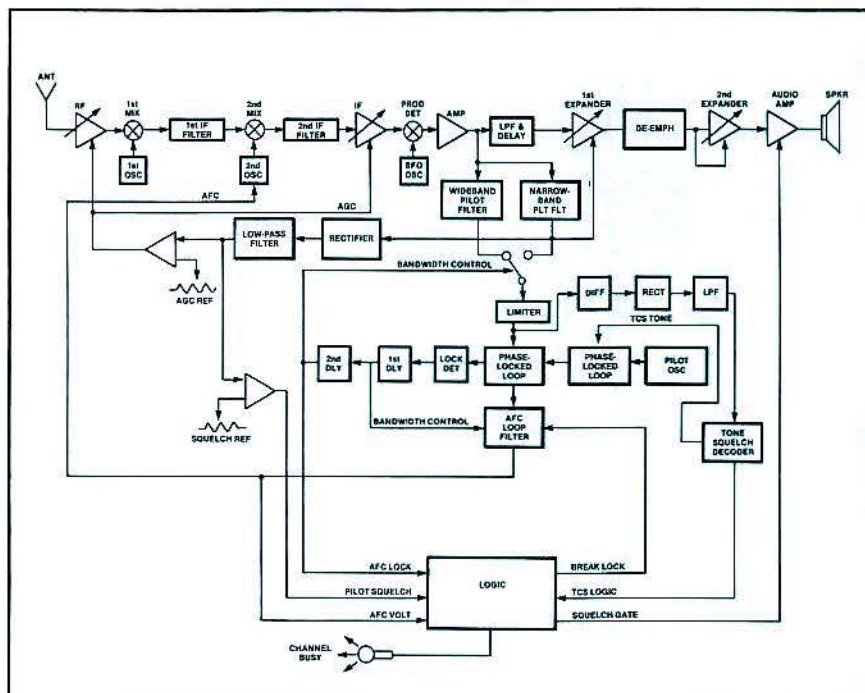


Figure 2. ACSSB receiver block diagram. Current radios phase-lock the receiver tuning to the transmitted pilot tone, using a locally derived pilot reference. A tuning error exists, but usually is 0.1Hz or less.

through the fade, the RF carrier phase changes, causing audible clicks and pops in the received signal. Although these clicks are a minor annoyance on voice signals, they can cause bit errors that result in garbled data. This problem is worse at higher RF frequencies because fades occur more often.

Anyone who has operated a mobile data terminal through an 800MHz radio at expressway speeds undoubtedly has encountered these fading-induced bit errors. To correct for these errors, mobile data terminal manufacturers usually incorporate either feed-forward error correction or error detection and retransmission. Both of these techniques can reduce the effective data throughput of the system significantly, resulting in slower system operation and increased use of valuable airtime.

Fortunately, modern technology has provided an answer to the problems encountered with FM. Ten

CONSIDER!

Knockoffs are a 'way of life' for some industries in our modern world. Why wouldn't you buy a lower-priced antenna with specifications that are identical? Elimination of 'development expense' by copying a leader's models, is one way of achieving lower cost. Why then have **KATHREIN** antennas replaced several competitors' models, both omni and directional, after only short-time use in cellular applications?

The difference is **experience!** There is much 'art' in both the design and manufacturing of these simple-appearing, but actually sophisticated devices. Corrections of design deficiencies that appear after some field exposure, are normal and necessary.

If you are close to the time for changing your cellular system to **SECTOR**, it may pay you to consider **KATHREIN's** all-weather panels. We have produced them for a number of years. In this application, therefore, they are becoming more-and-more

preferred by professionals!

KATHREIN INCORPORATED
26100 Brush Ave., Suite 319
Euclid, OH 44132
216-289-1271

SCALA ELECTRONICS CORP.
P.O. Box 4580
Medford, OR 97501
503-779-6500

21st Century Warranty... ...Today!



Outstanding reliability gives birth to a superior warranty.

In the olden days of **two way radio**, there were names like DUMONT, GALVIN, LINK and many others. They made fine radios. Somewhere along the line, the 90-day warranty was invented and became a permanent fixture in two-way radio sales brochures.

Unbelievably, the old 90-day warranty is still in existence today. It's really amusing to observe that some big companies still offer such an out-of-date warranty plan.

For those of you who prefer a more modern approach, we'd like to tell you about a warranty policy that FUJITSU TEN invented. We're not one of the "OLD TIMERS," so we think differently.

We believe that a proven quality product should be sold with a user protection policy that

goes beyond three months. We think that two years is the way to go, (especially when we know that only three-tenths of one percent have been returned over an eighteen month period).

FUJITSU TEN in fact will actually **exchange** the entire radio if it fails in use over a **two year** period following installation. You read correctly! Why take chances with the others when we offer total protection anytime within two years. Any company can do it, providing they have a product planned and executed on a "no-fail" design format.

If you believe, as we do, that old fashioned ideas are out of place in a modern world, then look into FUJITSU TEN. We provide 21st Century Technology...today.

YOU KNEW IT WOULD COME FROM FUJITSU TEN!

TEN-COM radios have so many new features, we ask that you contact us for the complete story. We'll tell you all the secrets that make TEN-COM the most cost-effective land mobile radios available today!



**FUJITSU TEN CORPORATION
OF AMERICA**
19281 PACIFIC GATEWAY DRIVE
TORRANCE, CALIFORNIA 90502
(213) 327-2151 or (800) 421-1996

MANUFACTURED BY FUJITSU TEN LIMITED

years ago the FCC, realizing that radio use was growing at a rapid rate, commissioned a study to determine whether there were more efficient alternatives to FM.

The FCC's UHF task force, under the direction of Dr. Raymond Wilmotte, contracted with Dr. Bruce Lusignan of Stanford University to develop a new form of modulation that combines the performance advantages of FM but occupies a fraction of the RF bandwidth. After several years of research and development, amplitude companded single-sideband (ACSSB) resulted. Some manufacturers refer to the mode as ACSB. It is a form of single-sideband (SSB) that combines most of the advantages of FM, plus a few of its own, and yet occupies only one-fifth of the RF bandwidth of current FM systems.

Single-sideband is a well-proven modulation technique that has been used widely by the military and ra-

dio amateurs. Its use has remained popular because of some important advantages, although it has some significant drawbacks as well. Table 1 on page 34 lists the advantages and drawbacks of SSB and how ACSSB overcomes the drawbacks.

ACSSB eliminates the disadvantages through the addition of amplitude companders and a pilot tone. The amplitude companders consist of compressors in the transmitter and expanders in the receiver to improve the signal-to-noise performance and to provide a capture effect comparable to FM. The pilot tone is a reference tone that is added to the transmitted signal to provide a reference for the receiver's phase-locked loop tuning. The tone also can be frequency-modulated to provide subaudible tone information.

In 1985, after four years of actual on-the-air tests by thousands of voice and data users, the FCC authorized narrowband 5kHz channels

in the 150MHz to 174MHz band, creating hundreds of new channel assignments. Although the new 5kHz narrowband channel assignments are available to any form of modulation that can meet the 3.6kHz maximum occupied bandwidth limitation, ACSSB is the only commercially available narrowband technology proven to be practical.

Numerous technical articles deal with present ACSSB theory of operation, so the theory will not be covered in any depth in this article. Figures 1 on page 26 and 2 on page 28 show diagrams of an ACSSB transmitter and receiver. In ACSSB radios currently manufactured by several vendors, the pilot tone is at 3,100Hz, and the audio passband is from 300Hz to approximately 2,500Hz. The receiver is phase-locked to the transmitted pilot tone, using a locally derived pilot reference.

Because the transmitted pilot tone

PROGRAMMABLE MEMORY DIAL

NOW A MEMORY WITHOUT BATTERIES

MODEL 2981 STANDARD FEATURES:

- Automatic Dialing
- Last Number Redial
- Manual Dialing
- Sidelone While Dialing
- Retains Memory Up To 5 Weeks Without External Power Source
- Program Memory Without Transmitting
- 10-Number Memory Of Up To 16 Digits Each (last number redial included)
- Automatic Mic Muting
- Automatic PTT
- All Weather Retractable Cable
- Crystal Controlled Tones
- Excellent Electret Mic Element For Maximum Voice Clarity
- Adjustable Dialing Speed
- Adjustable Output Levels



MODEL 2981 OPTIONAL FEATURES:

- DTMF Decode For Selcall
- Field Programmable For Up To 5 Digits
- Group Call & All Call
- Selectable Output For A Latched, Timed or Momentary Period

Bramco

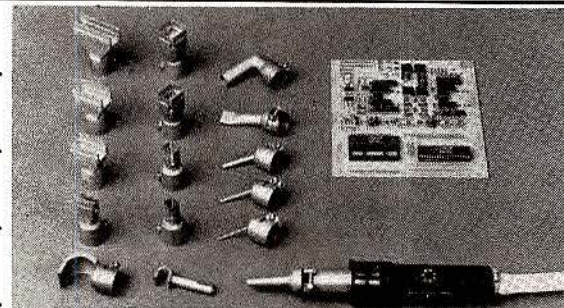
9676 N. Looney Rd.
P.O. Box 1482
Piqua, Ohio 45356
Ph. (513) 773-6255

- DTMF ANI
- Field Programmable
- Adjustable Output Level
- Adjustable Digit Rate

HOT AIR UP TO 600°C

with the
Leister-Labor "S" Hot Air Tool

For contactless de-soldering and soldering of
SMD- and DIP-components in 2-4 seconds.



Electronic Temperature Adjustment from 20
to 600°C. Three-Way Air Volume Adjustment

from 1 to 150 litres per minute.

ASK FOR BROCHURE MQ39

LEISTER

BW brian r. white co., inc.

313 HENRY STATION ROAD
UKIAH, CA 95482
FARMINGDALE, NJ 07727

(707) 462-9795
(201) 930-2700

DISTRIBUTOR INQUIRIES WELCOMED

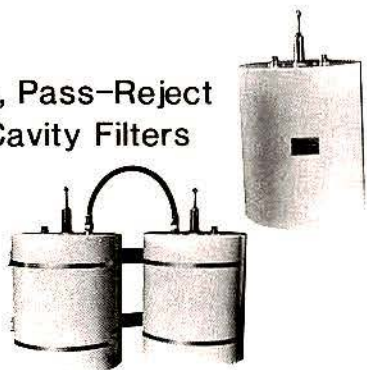
Circle (23) on Fast Fact Card

Circle (24) on Fast Fact Card

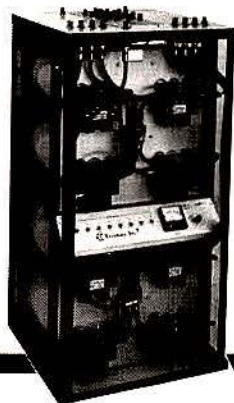
TELEWAVE'S "PROBLEM SOLVERS"

***Transmitter Combiners • Receiver Multicouplers
• Monitor Equipment • Test Equipment • Ferrite
Isolators and Terminations • High Q Cavities
and Filters • Duplexers • Systems Engineering***

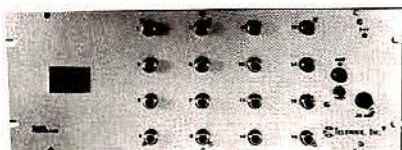
Bandpass, Pass-Reject
& Notch Cavity Filters



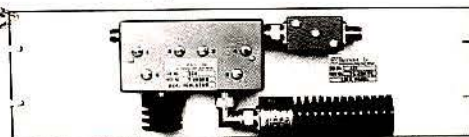
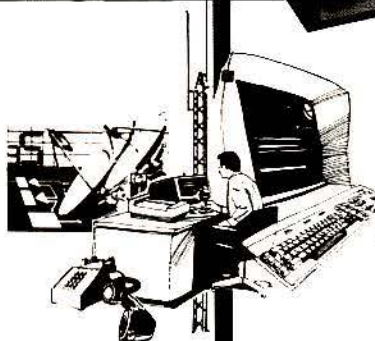
Transmitter Combining



Receiver Multicoupling



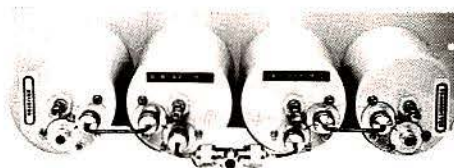
IM Suppression Panels



R.F. Power Monitoring



Duplexers & Preselectors



GSA Number 00K86AGS0646



(415) 968-4400

1155 Terra Bella Ave., Mountain View, CA 94043

(800) 331-3396

FAX: (415) 968-1741



TWX 910-379-5055

Circle (25) on Fast Fact Card

and the receiver reference pilot tone are derived from two independent oscillators, there is a slight receiver tuning error and, hence, a frequency offset in the received signal. The tuning error is equal to the absolute frequency difference between the two pilot tone oscillators. Fortunately this error is extremely small, on the order of 0.1Hz, because of pilot tones being derived from high-frequency crystal oscillators.

For most types of point-to-point data transmission, including DTMF, AFSK, APSK, QPSK and QAM, the 0.1Hz frequency offset is insignificant, and excellent bit error rate performance can be achieved. Figure 3 on page 36 is a curve of bit error rate vs. carrier-to-noise ratio for 300, 600, 1,200 and 4,800bps data.¹ These data were taken using ACSSB voice radios operated through the ANIK B satellite.

ACSSB data radios have been built and optimized for data by eliminating pre-emphasis and de-

emphasis networks and by modifying audio lowpass filters to minimize group delay. These data radios achieve approximately a 5dB improvement in carrier-to-noise ratio for the same bit error rate.

Many ACSSB data systems are in daily use in this country. The first one was installed in Tampa, FL, to control bridge and expressway traffic signs. Several SCADA systems have been implemented for oil and natural gas pipeline control, and one radio network is part of a complex system to monitor highway icing conditions and relay data to the local highway patrol office.

The largest system to date belongs to a major utility for use in its nuclear power plants. The system, when fully implemented, will use more than 300 ACSSB data radios to report radiation levels, wind direction and velocity, and temperature at hundreds of locations around the utility's nuclear plants. In addition, the system will energize

warning sirens in the event of an incident at one of the plants.

Advancements in ACSSB technology soon will result in a second generation of narrowband product with important advantages. This new generation of radio will be synchronous—that is, there will be no frequency offset in the received signal—and both the phase and amplitude effects of multipath fading can be eliminated in all but weak-signal conditions. What makes this possible is that the pilot tone can be used as an artificial carrier during the modulation-demodulation process. Figure 4 on page 40 is a block diagram of the audio processing using this new technique.

The transmit audio first is passed through a 3,100Hz notch filter that removes any audio components that may be present at the pilot frequency. A lowpass filter follows to remove any audio components that are above the pilot tone. The audio signal then is mixed with the

Selectone

ST-180



Shared Repeater Panel
\$215⁰⁰ *

- *Designed for smaller systems (up to 8 users)*
- *Digital CTCSS programming*
- *Busy channel lockout*
- *Tone translation*
- *Complete with one tone channel installed*
- *Optional remote on/off control*

* Special pricing expires 9/30/88.

TESSCOTM

Your Total Source[®]

DIRECT ORDER HOTLINE
800-638-7666

Touch 2

GDB

Circle (26) on Fast Fact Card

He Needs Answers



"Which exit is blocked?"
"How long will the roof last?"
"What if . . . ?"

Safety and efficiency depend on his ability to communicate with other fire team members.

Now Setcom's Face Mask Kit enables use of portable radios whenever SCBA is required.

Our bone conduction microphone delivers clear voice signals even in high ambient noise . . . and it won't compromise mask integrity.



SOUND IDEAS FROM
Setcom
CORPORATION

100 Sterling Road
Mountain View, CA 94035
415/965-8000

Circle (27) on Fast Fact Card

Decibel Base Station Antennas

Full Wave Dipole™, MTD™ and Aeroglas™ fiberglass omni and directionals, including downtilts, are offered by Decibel.

Fiberglass radome with Minimum Tip Deflection™

Unique, new Tapered Aeroglas™ Radome with Minimum Wind Loading

New Horizon Blue™ Color

Low-loss, semi-rigid enclosed cabling

No Dissimilar Metals

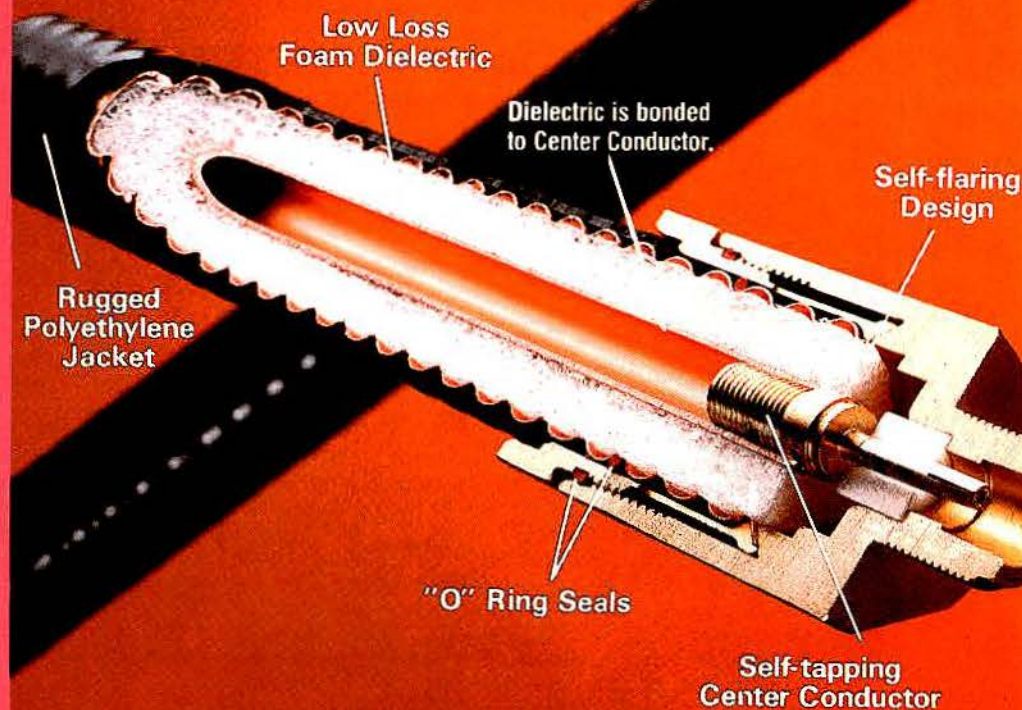
Moisture Resistant Design

Gold Irridite Support Pipe

Brushed 6061-T6 Aluminum Support Pipe

HELIAX Jumper Cables

Cutaway View Andrew LDF5-50A HELIAX Coaxial Cable with L45N Connector



For top performance in antennas and cable, team up with Decibel and Andrew!

The experienced team

For decades, Decibel antennas and Andrew HELIAX® coaxial cable have set the industry standards for top quality, long-term reliability, low maintenance and consistent user satisfaction.

The quality team

Decibel has the largest Quality Control Group in its field. Decibel antennas are inspected by QC personnel in every department during fabrication and are then given a final comprehensive test and inspection before shipment.

Andrew has been synonymous with quality since 1937. Its HELIAX assemblies and connectors undergo the most stringent quality controls in the industry, assuring you peak performance.

The design of HELIAX coaxial cable and connectors is unique, and constant monitoring and control assure that every cable assembly will deliver optimum performance.

The cost-effective team

Decibel antennas and HELIAX transmission line products actually save you money over the long term.

With Decibel and Andrew on your team, your bottom line costs are lower because your system performs better and lasts longer.

If you want the best possible system — if you want to stay ahead of the competition today and in the future — team up with Decibel antennas and Andrew HELIAX cable products, the best team you can assemble.

For more information, write Marketing, Decibel Products, Inc., P.O. Box 569610, Dallas, TX 75356-9610. Telephone: Marketing (214) 631-0310, other departments (214) 634-8502, Chicago Systems Engineering (312) 882-2190. Telex 73-0212. FAX (214) 631-4706.

HELIAX is a registered trademark of Andrew Corp.



Decibel Factory Authorized Warehouses: Tekcom, Inc., Costa Mesa and Union City CA; Talley Electronics Co., Hayward CA, Santa Fe Springs CA and Phoenix AZ; CW Electronics, Denver CO; The Antenna Farm, Overland Park KS; M. Hutton Co., Dallas and Houston TX; ComMar, Inc., Westport MA; TESCO, Inc., Hunt Valley MD, Tampa FL, Schaumburg IL, and Sparks NV; Primus Electronics Corp., Joliet IL.

International: Marketronics, Sunrise FL (for South America), Lenbrook Industries, Ltd., (Canada) St. Leonards, Quebec; Calgary, Alberta, and Pickering, Ontario, RAC, (Italy) Milan; Walmore Electronics, Ltd., (England) London; OmniTronics Enterprises PTE Ltd., (Singapore), Sistemas Profesionales S.A., (Mexico), Mexico City; R. F. Devices Pty., (NSW Australia) Miller.

Circle (28) on Fast Fact Card

**If you want quality,
you want Decibel and Andrew!**
Visit us at Expo East, Booth #404.

TABLE 1 — Comparison of single-sideband and ACSSB.

SINGLE-SIDEBAND

Advantages

- 1) Extremely spectrum-efficient — RF bandwidth is the same as the audio bandwidth.
- 2) Extremely power-efficient — Transmitter produces no power until it is modulated. Average power is only a fraction of peak power.
- 3) Excellent signal-to-noise — All the transmitter power concentrated in sideband where the information is contained. Receiver has much narrower bandwidth than FM.

Disadvantages

- 1) Receiver tuning critical — If tuning is incorrect, voice will be offset in frequency by same amount as tuning error. Can result in "Donald Duck" sound of SSB.
- 2) Subaudible signaling not possible — Radio sideband filter rolls off sharply below 300Hz to achieve adequate attenuation of the opposite sideband. Does not allow subaudible CTCSS operation.
- 3) Difficult to send data — Receiver tuning errors preclude any form of data transmission requiring receipt of accurate tone information such as DTMF, AFSK and APSK.
- 4) Lack of capture effect — Capture effect is the ability, when receiving two signals, to hear only the stronger signal, allowing more frequent reuse of existing channels. Amplitude modulated systems, because they do not use limiters, provide no capture effect.

ACSSB

Advantages

- 1) Very spectrum-efficient — RF bandwidth is only a few hundred hertz greater than the audio bandwidth.
- 2) Very power-efficient — With no voice, only pilot is transmitted at one-tenth of peak power. Average power is only a fraction of peak power.
- 3) Superior signal-to-noise — Amplitude companders enhance the already excellent signal-to-noise. Receiver has much narrower bandwidth than FM.

Solutions

- 1) Receiver automatically is tuned by phase-locked-loop tuning circuit that locks to the pilot tone.
- 2) Subaudible tones are generated by a low deviation FM modulation of the pilot tone.
- 3) Automatic tuning circuits limit frequency offsets to 0.1Hz. Usable with most forms of data.
- 4) The receiver expander circuits provide a capture effect similar to FM.

THE Bomar Power Line

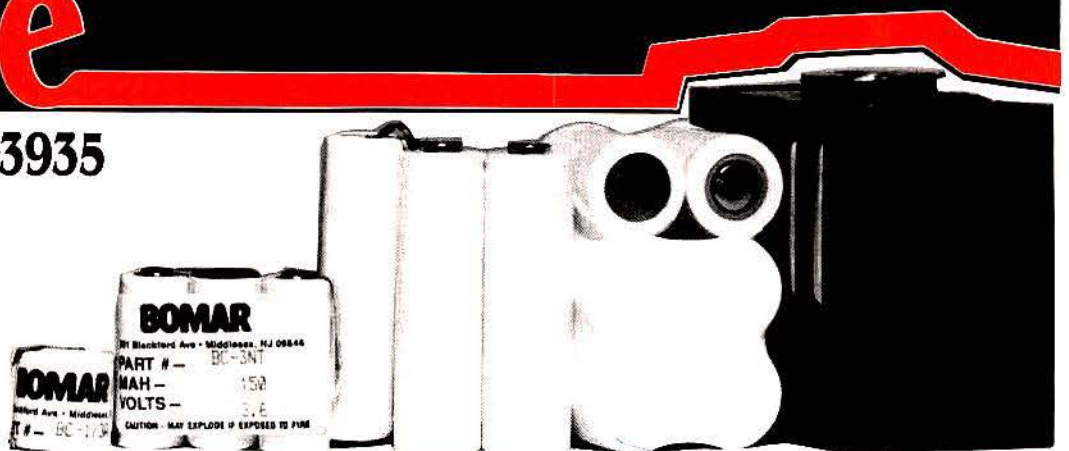
1-800-526-3935

For batteries that provide the power you need—when you need it. They are made to radio manufacturers' specs. Match the cosmetics of the radio. Guaranteed to work out of the box and main-

tain 80% rated capacity @ 12 months—are in stock for fast delivery. Service by professional sales and technical personnel. Make the BOMAR CONNECTION—Hotter than ever.

BOMAR

201 BLACKFORD AVENUE
MIDDLESEX, N.J. 08846
IN N.J. (201) 356-7787
FAX 201-356-7362
TWX 710-480-4650



Circle (29) on Fast Fact Card

Sentri-System gives you the word when there's trouble.



☒ User recorded voice alarms

Until now you had to go to the alarm panel or wait for your system to fail to know about a problem. With a Sentri-System you get a clear voice message sent to your pager, radio or P.A. system. A message that you record yourself tells you exactly what's wrong, it can even tell you what action to take.

☒ Status reports

Sentri-Systems are available for a range of systems starting with as few as eight contacts. These can be configured as normally open or normally closed, or you can send a message for a change of state. A simple DTMF sequence allows

you to interrogate status and receive a spoken report.

☒ Pager signalling

You can even send voice or alphanumeric

messages to specific people by using signalling options such as Two-Tone, GOLAY or POCSAG.

☒ Remote control

Sentri-Systems let you respond to the alarm message by remote control command. Sentri-Systems understand DTMF and have control outputs you can use to turn equipment on and off. You can even receive a voice confirmation that the remote action is complete.

☒ Printed log

Available with an RS-232 interface, Sentri-Systems can provide a hard copy of your system's activity.



ZETRON

We get the word out.

For more information, call (206) 644-1300

Zetron Inc., 2930 Richards Rd. S.E., Bellevue, WA 98005, FAX (206) 644-2661

Circle (30) on Fast Fact Card

3,100Hz pilot tone to produce two frequency spectrums: the sum (3,100Hz + audio) and the difference (3,100Hz - audio). The balanced mixer output is then lowpass-filtered to pass only the difference spectrum, resulting in an audio signal that is inverted around the 3,100Hz pilot.

The mixing is an important step because this is where the transmitted pilot tone enters the modulation process and becomes an artificial carrier. The inverted audio then is routed to a summing amplifier

AUDIO/PILOT TONE

Mixing audio with recovered pilot tone in the receiver:

- (1) Removes the audio frequency inversion.
- (2) Eliminates any frequency offset.
- (3) Removes the phase effects of multipath fading.

where the 3,100Hz pilot tone is added. Note that this is the same 3,100Hz tone previously mixed with the audio. The composite signal, inverted audio plus pilot, modulates the single-sideband transmitter.

The composite audio signal from the receiver first is split into an audio channel and a pilot channel. The 3,100Hz notch filter removes pilot tone from the audio and the narrow pilot filter is a bandpass filter that passes only pilot tone. The audio then goes through a CCD delay line to delay the audio signal slightly to compensate for the much longer time delay of the pilot signal through the narrow pilot filter.

Delayed audio signal is then lowpass-filtered to remove any noise or distortion products that may be above the pilot frequency. The signal then is mixed with received 3,100Hz pilot tone and lowpass-filtered to pass only the difference spectrum. Just as mixing audio with pilot tone in the transmitter used the pilot as a carrier for the modulation process, mixing audio with recovered pilot tone in the receiver uses the pilot as a carrier for the demodulation process. The benefits of doing this are the following:

(1) *Removes the audio frequency inversion*—Because the audio already was inverted, inverting it again returns the audio to normal.

(2) *Eliminates any frequency offset*—Because the recovered audio frequency is the difference between the pilot and audio frequency components of the received signal, the recovered audio frequency is independent of receiver tuning. Receiver tuning need be only sufficiently accurate to place received pilot tone within the pilot filter passband.

(3) *Removes the phase effects of multipath fading*—The phase variations of multipath fading result in a frequency modulation of the received composite signal. Because all components of the received signal shift in frequency together, the difference frequency remains constant, thereby removing the phase effects of multipath.

After the mixer and lowpass filter, the audio level is controlled by a feed-forward gain control stage.

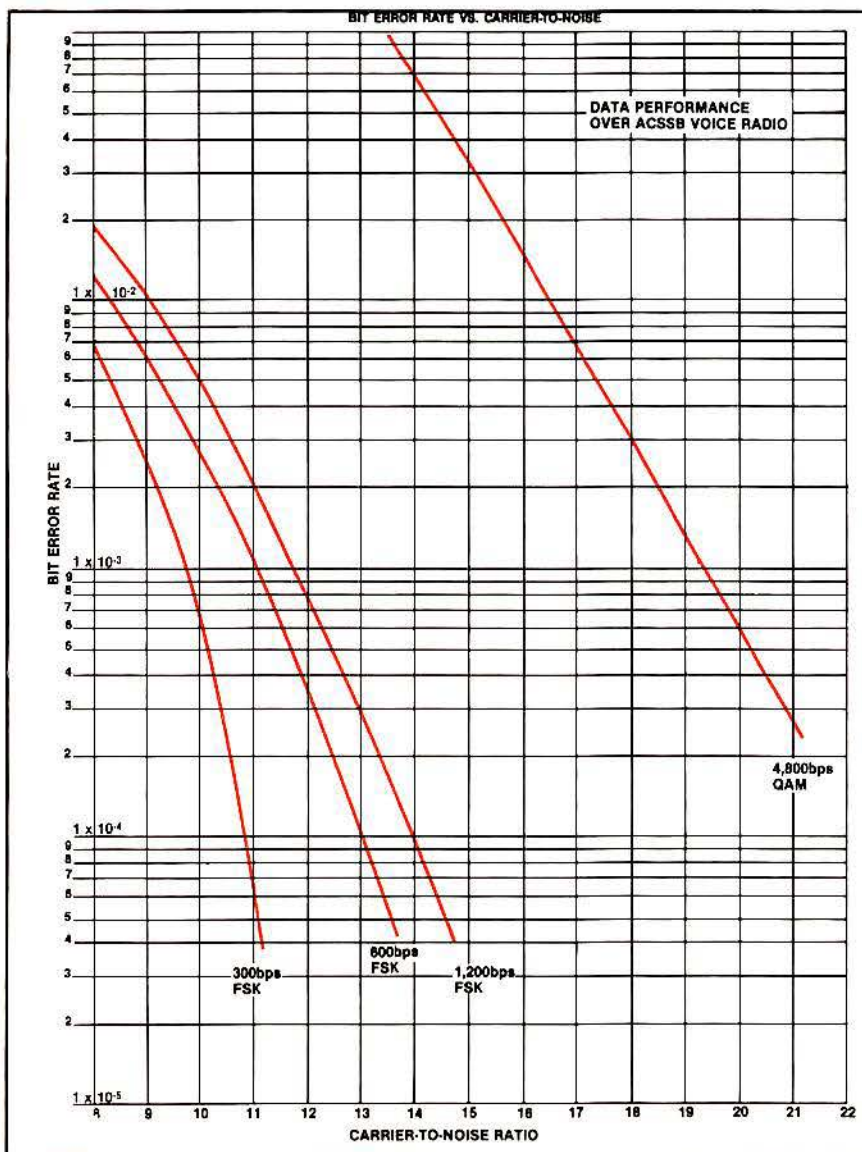
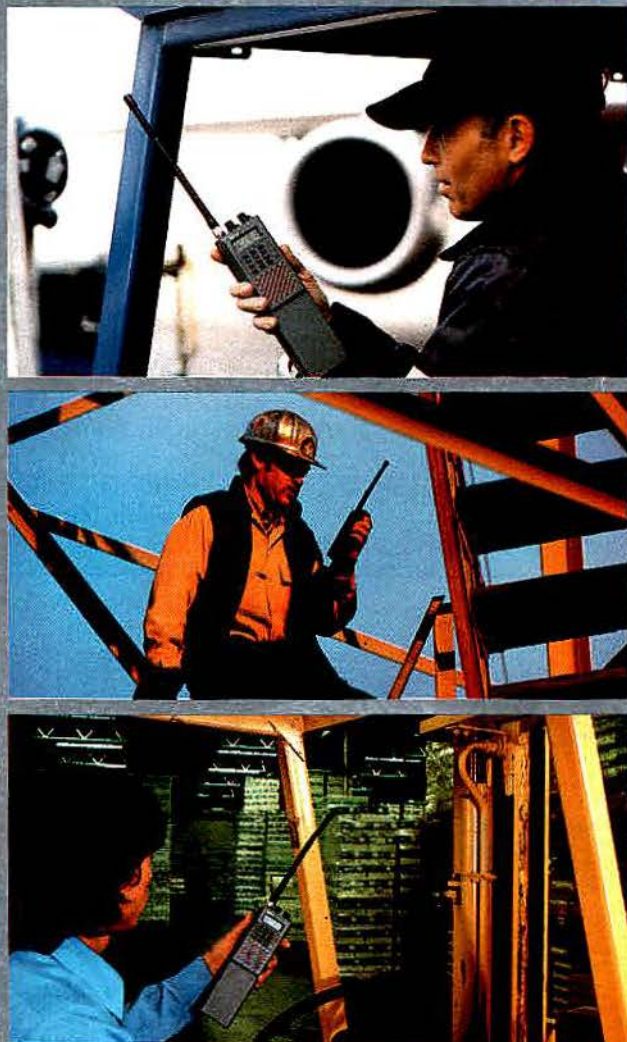



Figure 3. Data plotted represent bit error rate vs. carrier-to-noise ratio at several data rates. The data were taken using ACSSB voice radios operated through the ANIK B satellite. ACSSB radios designed for data-only transmission have an improved carrier-to-noise ratio that is 5dB greater for the same bit error rate.

RHT-800™

Price, Performance, Full-featured... AVAILABLE NOW



RHT-800™ by Repco

Since its introduction, the REPCOM 800 series handheld has proven to be superior in performance at an exceptional price. Once again, the REPCOM 800 series handheld leads the way with new TURBO software, designed to speed up access time and enhance overall performance.

The RHT-800 is a compact, easy-to-use handheld portable that can handle up to 10 systems and up to 10 groups. Standard features of the RHT-800 include: 10-system scan, elevated

dipole antenna, switchable 1/3W RF output, separate busy and out-of-range indicators, internal speaker, on/off switch and external speaker/microphone connector. A full line of options—such as a DTMF pad for interconnect—and accessories are offered to make this the most versatile 800 MHz trunked portable on the market today.

All this performance and proven Repco reliability comes to you at a price that will make you—and your customers—smile.



REPCO, INCORPORATED
2421 N. Orange Blossom Trail
P.O. Box 7065 • Orlando, Florida 32854-7065
(407) 843-8484 • Telex: 441117REPCO UI
1-800-327-5633

REPCO RADIO CANADA, LTD.
1060 Salk Road • Unit 6
Pickering, Ontario, Canada L1W 3C5
(416) 839-5911 • Telex: 06981407

Circle (31) on Fast Fact Card

CREATING PRODUCTS THAT COMMUNICATE... QUALITY

This stage is a variable gain amplifier whose gain varies inversely with the pilot tone level. This stage removes the amplitude variations due to multipath fading. For example, with a 10dB fade, the amplitude of the audio and pilot components decreases 10dB. As the pilot level decreases 10dB, the amplifier gain increases by 10dB, thereby restoring the audio level to its original prefade level. A muting circuit inhibits the output until a signal is received.

With the technique described above, the system's low-frequency audio cutoff is determined by the audio lowpass filters' corner frequency, and the high-frequency cutoff is determined by the radio sideband filter's low-frequency response. Even though the system's normal audio bandwidth response would range from 300Hz to 2,700Hz, the response can be tailored somewhat, if required, by changing the filter's characteristics.

ACSSB has several advantages

besides those already discussed. Unlike FM, ACSSB provides a linear channel and thus affords the possibility of transmitting combined amplitude and phase-encoded digital information with the associated improvements in bandwidth efficiency and error performance.

By employing high-level modem techniques such as quadrature amplitude modulation (QAM), a technique used in commonly available 9,600bps telephone modems, it should be possible to transmit data at rates approaching 20,000bps within 5kHz spaced channels. In fact, a QAM radio modem could be far simpler than a telephone modem because the radio's phase and amplitude distortion are known and fixed, and, thus, the radio path does not require adaptive equalization the way a telephone system does.

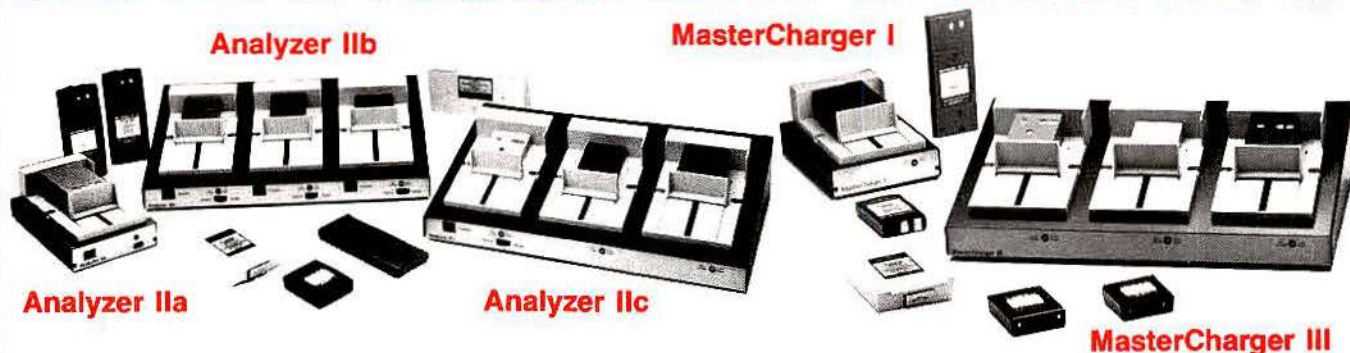
Coherent phase-shift keying (CPSK), although recognized as having the lowest bit error rate in the presence of white noise of all

known forms of data modulation, cannot be used effectively in some mobile data applications because of the irreducible error rate caused by random FM induced by multipath fading.

The irreducible error rate, because it is caused by the phase variations of multipath fading, does not get better as the signal becomes stronger. In fact, at frequencies in the 900MHz range, the irreducible error rate can be as high as 1×10^{-1} at a vehicle speed of 70mph. Clearly, if the best bit error rate that can be achieved is one wrong bit out of every 10, then enormous feed-forward error correction overhead will be required for successful message retrieval.

With some modifications to ACSSB circuitry, the pilot tone can be used as the reference for coherent detection. This technique has been successfully used by Bateman² and others at the University of Bath in England. These tests proved that a

BATTERY ANALYZERS & CHARGERS



**W & W ASSOCIATES PRESENTS:
THE ALL NEW FAMILY OF AFFORDABLE AND LEGITIMATE NICAD
ANALYZERS AND CHARGERS.**

Please inquire for additional information and pricing.



W & W ASSOCIATES • 29-11 Parsons Boulevard • Flushing, N.Y. 11354
WORLD-WIDE DISTRIBUTORSHIPS AVAILABLE. PLEASE INQUIRE.

In U.S. & Canada Call Toll Free (800) 221-0732 In N.Y.S. (718) 961-2103 • Telex: 51060 16795 • Fax: (718) 461-1978

Visit us at Expo East, Booth #440

Circle (32) on Fast Fact Card

MODEL VS-50M

RS, RM and VS SERIES

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output.
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-4A, RS-5A.
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •

- THREE CONDUCTOR POWER CORD
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105 - 125 VAC
- OUTPUT VOLTAGE: 13.8 VDC \pm 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE: Less than 5mv peak to peak (full load & low line)
- Also available with 220 VAC Input Voltage

RM-A SERIES

MODEL RM-35M

19" X 5 1/4" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RM-12A	9	12	5 1/4 x 19 x 8 1/4	16
RM-35A	25	35	5 1/4 x 19 x 12 1/2	38
RM-50A	37	50	5 1/4 x 19 x 12 1/2	50
• Separate Volt and Amp Meters				
RM-35 M	25	35	5 1/4 x 19 x 12 1/2	38
RM-50 M	37	50	5 1/4 x 19 x 12 1/2	50

RS-A SERIES

MODEL RS-7A

RS-4A	3	4	3 3/4 x 6 1/2 x 9	5
RS-5A	4	5	3 1/2 x 6 1/8 x 7 1/4	7
RS-7A	5	7	3 3/4 x 6 1/2 x 9	9
RS-10A	7.5	10	4 x 7 1/2 x 10 3/4	11
RS-12A	9	12	4 1/2 x 8 x 9	13
RS-20A	16	20	5 x 9 x 10 1/2	18
RS-35A	25	35	5 x 11 x 11	27
RS-50A	37	50	6 x 13 3/4 x 11	46

RS-M SERIES

MODEL RS-35M

• Switchable volt and Amp meter				
RS-12M	9	12	4 1/2 x 8 x 9	13
• Separate volt Amp meters				
RS-20M	16	20	5 x 9 x 10 1/2	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13 3/4 x 11	46

VRM/VS-M SERIES

MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts				
• Current limit adjustable from 1.5 amps to Full Load				
@ 13.8VDC or 10VDC or 5VDC @ 13.8V				
VS-20M	16	9	4	20
VS-35M	25	15	7	35
VS-50M	37	22	10	50
• Variable rack mount power supplies				
VRM-35M	25	15	7	35
VRM-50M	37	22	10	50

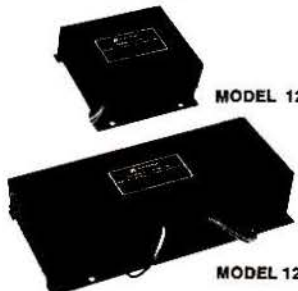

5 x 9 x 10 1/2	20
5 x 11 x 11	29
6 x 13 3/4 x 11	46

5 1/4 x 19 x 12 1/2	38
5 1/4 x 19 x 12 1/2	50

* ICS—Intermittent Communication Service (50% Duty Cycle 5 min. on 5 min. off)

*ICS—Intermittent Communication Service (50% Duty Cycle 5 min. on 5 min. off)

DC-DC CONVERTERS

 <p>MODEL 1212</p> <p>MODEL 1212-18</p>	<p>MODEL 1212 & 1212-18 Switching Regulated Converter.</p> <p>Designed for FM transceivers and other applications requiring 12 volt power source converted from 12 volt positive ground battery. Regulation with pulse width modulation at 20 KHz. Input—12V DC (Positive ground only). Functional from -11 V DC to -16 V DC. Output +13.8 V DC (Negative ground only).</p> <table><tr><td></td><td>1212</td><td></td><td>1212-18</td></tr><tr><td>Output Voltage</td><td>13.8 V DC</td><td>\pm.2 V DC</td><td>13.8 V DC \pm.2 V DC</td></tr><tr><td>Line/Load Regulation</td><td>200 mV</td><td></td><td>200 mV</td></tr><tr><td>Ripple/Noise</td><td>50 mV RMS</td><td></td><td>50 mV RMS</td></tr><tr><td>Current Continuous</td><td>6 Amp</td><td></td><td>14 Amp</td></tr><tr><td>Current (ICS)</td><td>9 Amp</td><td></td><td>18 Amp</td></tr><tr><td>Current Limit</td><td>12 Amp</td><td></td><td>19 Amp</td></tr><tr><td>Case</td><td>2 3/4" (H) x 6" (W) x 6" (D)</td><td></td><td>2 3/4" x 6" x 12"</td></tr><tr><td>Shipping Weight</td><td>2 lbs.</td><td></td><td>4 lbs.</td></tr></table>		1212		1212-18	Output Voltage	13.8 V DC	\pm .2 V DC	13.8 V DC \pm .2 V DC	Line/Load Regulation	200 mV		200 mV	Ripple/Noise	50 mV RMS		50 mV RMS	Current Continuous	6 Amp		14 Amp	Current (ICS)	9 Amp		18 Amp	Current Limit	12 Amp		19 Amp	Case	2 3/4" (H) x 6" (W) x 6" (D)		2 3/4" x 6" x 12"	Shipping Weight	2 lbs.		4 lbs.
	1212		1212-18																																		
Output Voltage	13.8 V DC	\pm .2 V DC	13.8 V DC \pm .2 V DC																																		
Line/Load Regulation	200 mV		200 mV																																		
Ripple/Noise	50 mV RMS		50 mV RMS																																		
Current Continuous	6 Amp		14 Amp																																		
Current (ICS)	9 Amp		18 Amp																																		
Current Limit	12 Amp		19 Amp																																		
Case	2 3/4" (H) x 6" (W) x 6" (D)		2 3/4" x 6" x 12"																																		
Shipping Weight	2 lbs.		4 lbs.																																		
 <p>MODEL 2412</p> <p>MODEL 2412-16</p>	<p>MODEL 2412 & 2412-16 Switching Regulated Converter.</p> <p>Designed for FM transceivers and other applications requiring 12 volt power source converted from 24 volt battery. Regulation with pulse width modulation at 20 KHz. Input +28 V DC (Negative ground only). Functional from + 22 V DC to +32 V DC. Output +13.8 V DC (Negative ground only).</p> <table><tr><td></td><td>2412</td><td></td><td>2412-16</td></tr><tr><td>Output Voltage</td><td>13.8 V DC</td><td>\pm.2 V DC</td><td>13.8 V DC \pm.2 V DC</td></tr><tr><td>Line/Load Regulation</td><td>200 mV</td><td></td><td>200 mV</td></tr><tr><td>Ripple/Noise</td><td>50 mV RMS</td><td></td><td>50 mV RMS</td></tr><tr><td>Current Continuous</td><td>9 Amp</td><td></td><td>16 Amp</td></tr><tr><td>Current Limit</td><td>12 Amp</td><td></td><td>20 Amp</td></tr><tr><td>Case</td><td>2 3/4" (H) x 6" (W) x 6" (D)</td><td></td><td>2 3/4" x 6" x 12"</td></tr><tr><td>Shipping Weight</td><td>2 lbs.</td><td></td><td>4 lbs.</td></tr></table> <p>ALSO! AVAILABLE AS MODEL 3612 & 3612-16: +36 V DC (Negative ground only) AND AS MODEL 4812 & 4812-16: +48 V DC (Negative ground only).</p>		2412		2412-16	Output Voltage	13.8 V DC	\pm .2 V DC	13.8 V DC \pm .2 V DC	Line/Load Regulation	200 mV		200 mV	Ripple/Noise	50 mV RMS		50 mV RMS	Current Continuous	9 Amp		16 Amp	Current Limit	12 Amp		20 Amp	Case	2 3/4" (H) x 6" (W) x 6" (D)		2 3/4" x 6" x 12"	Shipping Weight	2 lbs.		4 lbs.				
	2412		2412-16																																		
Output Voltage	13.8 V DC	\pm .2 V DC	13.8 V DC \pm .2 V DC																																		
Line/Load Regulation	200 mV		200 mV																																		
Ripple/Noise	50 mV RMS		50 mV RMS																																		
Current Continuous	9 Amp		16 Amp																																		
Current Limit	12 Amp		20 Amp																																		
Case	2 3/4" (H) x 6" (W) x 6" (D)		2 3/4" x 6" x 12"																																		
Shipping Weight	2 lbs.		4 lbs.																																		

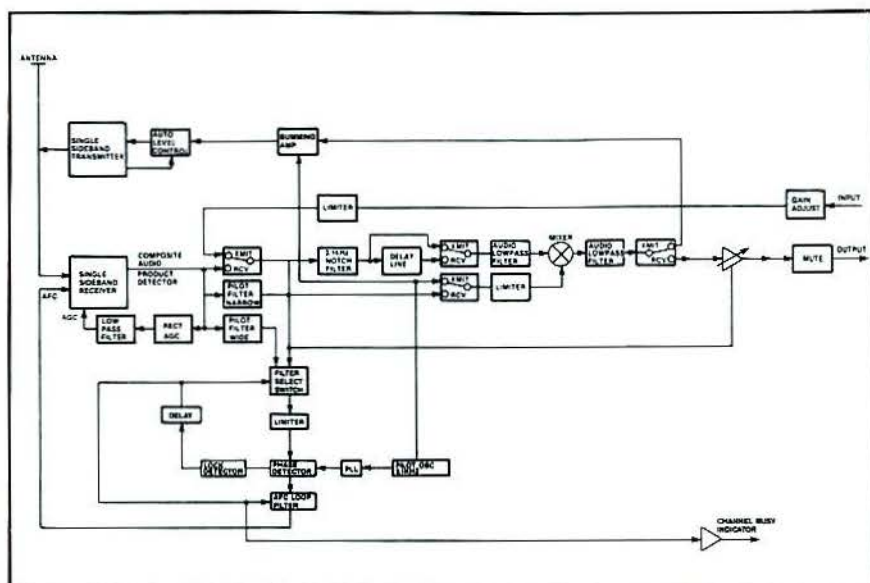


Figure 4. Block diagram of new circuits that process ACSSB signals to maximize data throughput. Synchronous frequency control eliminates received signal offset. Phase and amplitude effects caused by multipath fading virtually are eliminated in all but weak-signal conditions. The circuit uses the pilot tone as an artificial carrier during the modulation-demodulation process.

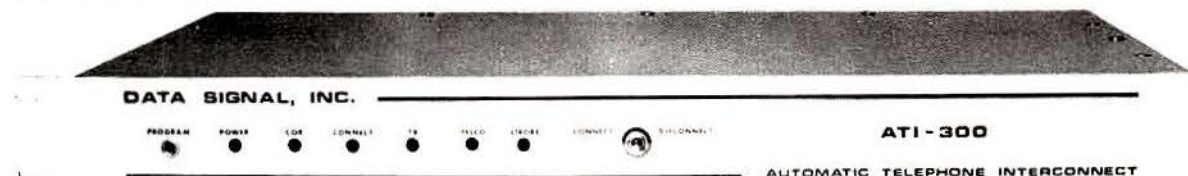
single-sideband radio system, using phase and amplitude correction circuitry, can send CPSK data without the usual irreducible error rate, achieving improvements in bit error rates of two orders of magnitude.

ACSSB, although still in its infancy, holds the promise of revolutionizing the radio industry. Its ability to convey both voice and data in extremely narrow bandwidth is well proven, and new techniques, soon to appear commercially, promise to increase its performance further, especially for mobile data.

References

- (1) Pike, C., Suitcase: "Telephony Terminal," Communications Research Center, Department of Communications of Canada, September 1985.
- (2) Bateman, A.J., G. Lightfoot, A. Lymer and J.P. McGeehan, "Speech and Data Communications Over 942MHz TAB and TTIB Single-Sideband Mobile Radio Systems Incorporating Feed-Forward Signal Regeneration," *IEEE Trans. Veh. Tech.*, VT-34, No. 1, February 1985, pp. 13-21.

AUTOMATIC TELEPHONE INTERCONNECTS



TWO NEW INTERCONNECTS

ATI-100
\$249-\$369

- Full, Half-Duplex or Simplex operation
- Electronic voice delay
- Desk or Rack Mount version
- */# Connect/Disconnect
- Regenerated Tone or Pulse Dialing
- Direct Voice Dispatching
- Selective Calling (DTMF-DTMF)
- Mobile Activity and Timeout Timer
- Ringout or Auto Answer on 1-4 rings
- Busy Channel Ringout Inhibit
- Transorb Lightning Protection
- Front Panel station LED's
- COS polarity reversal
- 12 VDC powered

ATI-300
\$495-\$595

- All of the Features of the ATI-100, plus:
- Local and remotely programmable via DTMF
- 35 programmable ANI's (Local or remote)
- Verified Global or ANI Access
- Verified Positive Disconnect
- Toll restriction per user (local or remote)
- Two-tone pager
- Control Station capabilities
- DTMF, CTCSS, 2-tone Selective Call
- Mobile-to-mobile Selective Call
- Verified Repeater Access
- CWID-Local or Remote Programmable
- Channel Monitor Capabilities
- DTMF or Rotary Overdialing
- Programmable Voice after Page
- Auxiliary Relay for Channel Control
- Three Programmable Relays for Remote Control
- Busy Signal Disconnect
- Dial Tone Disconnect
- Telco Go-ahead Tone (Programmable)
- Dip Switch Programmable Timing
- Dip Switch Selectable Features
- Simplex Electronic Voice Delay
- Half-Duplex Privacy Modes
- Busy Lockout
- Programmable Secret Access Code
- Unique Station Signalling Tone
- All Features are standard

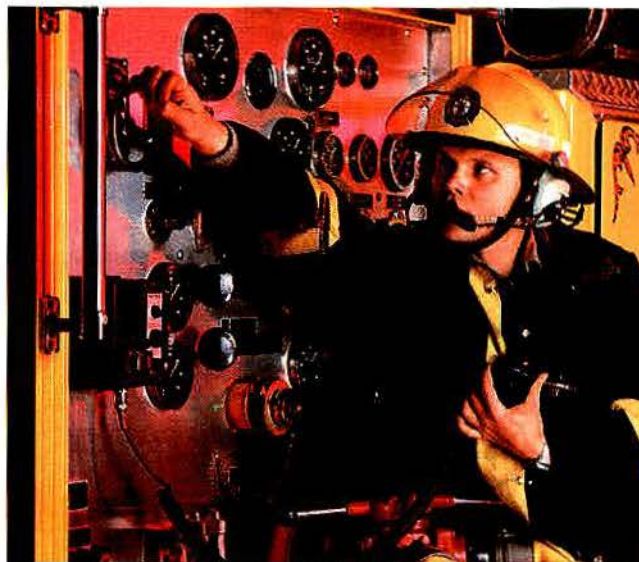


2403 Commerce Lane
Albany, Georgia 31708
Telephone: 912-883-4703
Toll Free: 800-652-9296

THE PERFECT MATCH.



**YOUR
RADIO
AND
OUR**



NOISE ATTENUATING HEADSET.



High noise can make two-way radio communication difficult, if not impossible. Combine your two-way radio with one of our Noise Attenuating Headsets to solve this problem.

David Clark Company Headsets combine maximum hearing protection, with comfort and perfect reception. Superior noise-canceling microphones deliver clear transmissions at normal voice levels.



Our headsets and radio adapters are designed for durability, with quality and performance guaranteed. **NO RADIO MODIFICATIONS ARE NEEDED.** Choose between hands-free VOX (voice activated) or Push-To-Talk operation. Headsets with throat microphones are also available.

For more information and a FREE DEMONSTRATION, call or write.



David Clark COMPANY
INCORPORATED

360 Franklin St., Box 15054, Worcester, MA 01615-0054
Phone: (508) 756-6216 • Telex: 920482 • FAX: (508) 753-5827

Circle (35) on Fast Fact Card

Expo/East preshow overview

Event: Land Mobile Expo/East

Dates: Sept. 14-16

Location: Georgia World Congress Center

City: Atlanta

Number of Exhibitors: 175 to 200

Projected number of Attenders: 2,000 to 2,500

Exhibit Hours: Wednesday, Sept. 14, 2 to 6 p.m.

Thursday, Sept. 15, 10 a.m. to 5 p.m.

Friday, Sept. 16, 10 a.m. to 2 p.m.

Registration/Hotel Information: 303-220-0600.

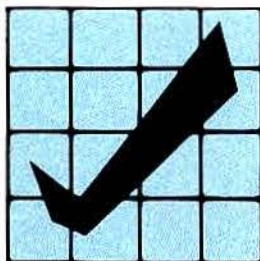
More than 150 exhibitors will be on hand at Land Mobile Expo/East scheduled Sept. 14-16 in Atlanta. Equipment on display will include antennas, paging equipment and accessories, tone signaling and control equipment, radiotelephones, batteries, test equipment, components, enclosures, cellular telephones and towers.

The keynote luncheon will be Wednesday, Sept. 14, from noon to 2 p.m. Sessions will cover the future of cellular with digital; international trade; paging opportunities; antennas and site management; data communications via land mobile technologies; emerging technologies; and FCC actions.

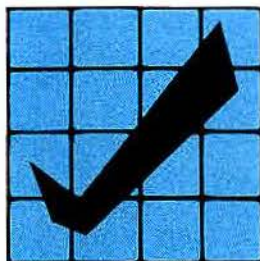
Mobile Radio Technology will be in

booth 230. Information printed here represents what was available as of press time.

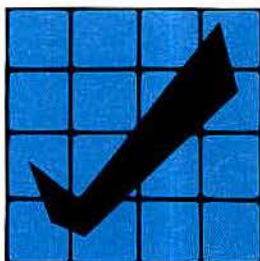
To help you choose booths to visit, check the products and services that interest you and take this list to Expo/East. At the show, refer to the show guide to find the manufacturers that are exhibiting this equipment.



- ☐ Antennas and antenna system accessories
- ☐ Multicoupler and multicoupler system products
- ☐ Paging equipment and accessories
- ☐ Radiotelephone and radiotelephone interconnect equipment
- ☐ Tone signaling and control equipment
- ☐ Base station repeaters
- ☐ Management information systems
- ☐ Data transmission equipment



- ☐ Coaxial connectors and accessories
- ☐ FCC liaison, database service and application preparation
- ☐ Transceivers
- ☐ Batteries
- ☐ Cellular telephones
- ☐ Chargers/amplifiers
- ☐ Consulting service
- ☐ Trade publications
- ☐ Crystals
- ☐ Test equipment
- ☐ Towers



- ☐ Batteries—chargers/analyzers
- ☐ Channel element installation
- ☐ Auxiliary equipment and services
- ☐ Special radios
- ☐ Shielded enclosures
- ☐ Equipment shelters
- ☐ Voice message/storage
- ☐ Accessories and hardware
- ☐ Trade associations
- ☐ Computer aided dispatch
- ☐ SCADA systems
- ☐ Financial services

Clearly Profitable

Now as a qualified reseller, you can put the crisp clean sound of the Motorola Radius line-up of Mobile and Portable two-way radios to work for you.

You will appreciate the sales materials and outstanding programs that will help you sell more products.

Your customers will appreciate the tradition of quality that stands behind all products designed by a world leader in business and personal communications.

Radius by Motorola...Clearly affordable for your customers...Clearly profitable for you.

P100 PORTABLE

Synthesized two or six channel operation VHF or UHF. Field programmable with self-diagnosis for faults on power-up. Accessories include remote speaker/microphone and rapid-rate charger & batteries. Two year limited warranty.

Model: P100

Frequency:

VHF:

150.8-162.0 MHz

UHF:

450.0-470.0 MHz

Dimensions:

6.3" x 2.6" x 1.8"

Weight: 24 oz.

Transmitter Power:

VHF:

1 or 5/1 Watts

UHF:

1 or 4/1 Watts



MOBILES

Synthesized multiple channel operation, field programmable compact dash-mount radios featuring M100 two channel model, the totally new M206 six channel model and the just introduced 14 channel M214 with scanner. All models feature multiple tone or digital squelch codes. Two year limited warranty.

Model: M100/M206/M214 Mobile

Frequency:

VHF: 136.0-174.0 MHz

UHF: 449.0-470.0 MHz

800 MHz: (Tx) 806.0-825.0 MHz

(Rx) 851.0-870.0 MHz

Dimensions: 2" x 7" x 7.75"

Transmitter Power: VHF: 25/40 Watts

UHF: 25/35 Watts

800MHz: 15 Watts

See us at the
Land Mobile
Expo Booth #740/742.

P50 PORTABLE

NEW

One or two channel operation. Capable of either carrier or coded squelch formats and is available in either UHF or VHF models, high or low power. Accessories include Quick-Rate Desktop Charger, headset, earpiece, remote speaker / microphone. Two year limited warranty.

Model: P50

Frequency:

VHF:

150.8-162.0 MHz

UHF:

450.0-470.0 MHz

Dimensions:

Low Power:

5.6" x 2.5" x 1.2"

High Power:

6.7" x 2.5" x 1.2"

Weight:

Low Power: 12.0 oz.

High Power: 15.5 oz.

Transmitter Power:

VHF: 2 or 5 Watts

UHF: 1 or 4 Watts



Visit your Radius dealer to learn how a Radius System can put more talking power in the hands of the people working for you.

Or call 1-800-622-0030 for the name of the Radius dealer nearest you. Qualified Dealer Inquiries Welcome.



MOTOROLA and Radius are registered trademarks of Motorola, Inc.

Circle (36) on Fast Fact Card

1301 E. Algonquin Road
Schaumburg, IL 60196

Many MSSs, few dealers carry Motorola Radius

Although Motorola's low-tier two-way radio product line, Radius, has been made available since April to dealers to resell to end-users, few dealers have adopted the line. Nonetheless, the Schaumburg, IL, manufacturer has vigorously promoted the line via:

- direct mail and factory-placed advertising backed by toll-free ordering service.

- Motorola Service Station (MSS) operators who formerly only repaired the company's product (and who continue to offer repair service).

- sales companies who distribute catalogs and other forms of advertising nationwide.

One dealer who elected not to carry Radius cited the same reason he believes Motorola has for not permitting its factory-direct sales force to offer the line: the cost of putting a sales representative on the street. "You have to sell a lot of \$199 radios to support a sales representative," he said. "If Motorola is no dummy, why should we be?"

He also said his goal is to sell radios with higher quality than Radius represents, and he expressed a desire not to alienate his current suppliers.

Reseller qualifications

Motorola seeks experienced, reputable resellers. Among MSS operators, a minimum of 10 years' experience seems to be the rule. MSSs are offered discounts ranging from 20% to 50%, depending upon quantities purchased. Incentives are offered for prompt payment.

As far as two-way radio dealers are concerned, offers to become resellers have been extended first to the largest

dealers, those with more than \$500,000 in annual sales. Smaller dealers still await substantive discussion with Motorola management. "We sent in their coupon, and I gave a Radius representative my business card in Las Vegas [during a trade show held in April], but we haven't heard from them," one dealer said.

Dealers who become Motorola Radius resellers are not offered prices as low as those offered the MSSs, leaving them at a competitive disadvantage. MSS sales representatives are able to offer potential customers better pricing.

One of the nation's largest dealers, Mobile Radio Inc. (MRI), is a reseller. MRI, Stanton, CA, is part of the Fleet Call group of companies. It has 11 sales and service divisions in California. MRI vice president of marketing Ron Domres echoed the concern of the dealer who rejected the line: "In today's employment marketplace, with a sales and service dealership, I'm not convinced that you can hire the quality of people you're looking for and pay them on a 40% margin, which is common in this industry."

To increase profits, dealers have to take advantage of every discount the manufacturer offers. The best discount is offered those who send cash with the order, "which is ideal, from the manufacturer's standpoint," Domres said. "From the dealer's standpoint, you're spending money before you've turned it." Motorola offers other terms, such as 10 days net, but the discounts are not as favorable as they are for cash with the order. "You need as much margin as you can get," Domres said. "To get the maximum, you pay up front."

Quantity discounts are offered, too. The maximum discount is offered for orders of 40 units or more.

According to Domres, Motorola imposes stocking requirements. "That eliminates smaller dealers who are not serious but who would like to carry the Motorola name," he said.

Instead of a co-op advertising program, Motorola offers resellers a rebate program based on a percentage of equipment sales. "What is unusual," Domres said, "is that they refund this money to you with no restrictions on how to use it."

Domres indicated all his sales representatives are excited and are eagerly anticipating receiving the Motorola equipment. He said they believe the Radius line will fill a void in the marketplace.

Marketing change

For MSSs, the ability to sell two-way radio products represents a dramatic change in direction. "Motorola presented a lot of resistance to MSSs who wanted to sell products," said one MSS operator who resells Radius. "There was nothing on paper, but Motorola managers impressed upon MSSs their preference that MSSs not sell two-way radio products and not service other brands. We heard stories of MSS contracts being canceled because the operators supported other manufacturers' products. Motorola has been a real tight organization. But obviously Motorola management believed that if the company was going to continue as an industry leader, it had to change the way it offers low-tier products," he said.

Motorola extensively researched possible ways to offer Radius to dealers.



RACK MOUNTED REPEATER AMPLIFIERS

VHF-UHF-800 MHz

- Continuous duty for repeater/paging applications
- 25, 50, 100 or 200 watt output
- Available with drives from 200 mW to 50 watts
- Primary power 13.8V dc or optionally 90-130V ac, 60 Hz
- Aligned and tested on your frequencies for maximum output and efficiency

Call 1-800-USA-MADE
(312/885-3296)

VoCom
PRODUCTS CORPORATION
1161 E. Tower Rd., Schaumburg, IL 60173

mobile amplifiers available

Circle (37) on Fast Fact Card

SAVE TIME

For fast, accurate service, please remove the Peel-Off Label (which is used to address your magazine) and affix it to the Fast Fact Card, the Address Change Card, or to any correspondence you send us regarding your subscription.

IN-STOCK FOR IMMEDIATE SHIPPING



Affordable Wireless Data Recorder

At only \$595.00 printed communication between base station computers and mobile units is now affordable for everyone. The AR1200

stores and prints messages or receives and prints simultaneously. Easy to operate; compact size; full 40 characters per line printer output.

Also available, other computer and data transmitting products.



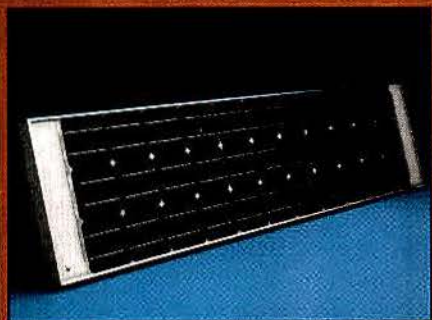
Tempo™ Mobile Radios

Economical, reliable mobile transceivers are available for immediate shipment. Several models offer a choice of features to the two-way customer. Type accepted for all business and public safety uses.



RF Power Amplifiers

We've got RF Amplifiers in-stock. Delivery when you need it. Guaranteed to specs, year after year. We've got our dependable reputation behind these products and offer them at realistic prices. You can count on Henry Radio!



Hoxan™ Photovoltaic Products

The reliability of Hoxan solar products is backed by a 10 year guarantee. True quality that lets you enjoy complete independence from utility lines or fuel storage tanks. Completely modular units can add or subtract from a system easily. Reliability, independence, modularity, economy, safety. Henry Radio is your best choice for communications power.

*Over a half-century of
reliability in communications.*

Also in stock: ASTRON Power Supplies, CUSHCRAFT Antennas, LARSEN Antennas, MAXCOM Antenna Tuners, PIPO Touchtone Pads, MAG INSTRUMENTS Flashlights plus much more two-way and amateur radio equipment and supplies.



HENRY RADIO

2050 S. Bundy Drive, Los Angeles, CA 90025; toll free:
1-800-877-7979; FAX: 1-213-826-7790
Circle (34) on Fast Fact Card

"We first were interviewed in 1986," one dealer said. "It seemed as though they wanted to figure out how big we were."

"They interviewed us a second time in November 1987. That time, they wanted to know whether we would continue the four lines we currently represent or whether we would consider taking Radius as a single line. I guess they didn't like our answers; they didn't offer us the line. The MSS in our town does offer the line."

A/S supports communications at Telocator Spring Meeting

Antenna Specialists, Cleveland, provided its Extend-A-Cell cellular booster system to enhance cellular coverage within the convention hall at the Telocator Spring meeting in St. Louis. RF coverage inside the convention center was poor, and exhibitors would have been unable to demonstrate their cellular products effectively without the booster.

Metroteller expands RF-based test

Metroteller Systems, Buffalo, NY, has expanded its product trial of a radio-frequency data communications network designed and manufactured by Bydatel Corporation, Buffalo. Bydatel's Data-Mover Network bypasses leased telephone lines and permits computers and terminals to communicate with each

other using cellular radio technology.

Metroteller began a pilot test in September using Bydatel's DataMover to transmit banking information and is adding automatic teller machines to its network test. Its system in Buffalo can support multiple customers in synchronous and asynchronous environments.

Two Southwest distributors reach sales-agency agreement

Hutton Communications, Dallas, and National Tower Services, Houston, each represent all the products that have been carried by the other, allowing both companies to provide more than 30 lines of antenna, cable, power, test, radio, signaling, telemetry, accessory and shop equipment. A distribution and sales-agency agreement has expanded sales and support capabilities in both companies' offices. Hutton's Dallas facility contains the principal inventory.

GE, Aerotron sign licensing pact

General Electric Mobile Communications, Lynchburg, VA, and Aerotron, Raleigh, NC, have signed a licensing agreement that calls for GE to provide the necessary protocols to make Aerotron's MEGA mobile radios compatible with GE's 16 PLUS digital trunked 800MHz radio system. An initial application of the arrangement is a proposal to supply a GE 16 PLUS PST system with Aerotron radios to the New York City Transit Authority.

TALK HANDS FREE

Headsets, Throat Mic, Ear Mic

FLEXICOM®

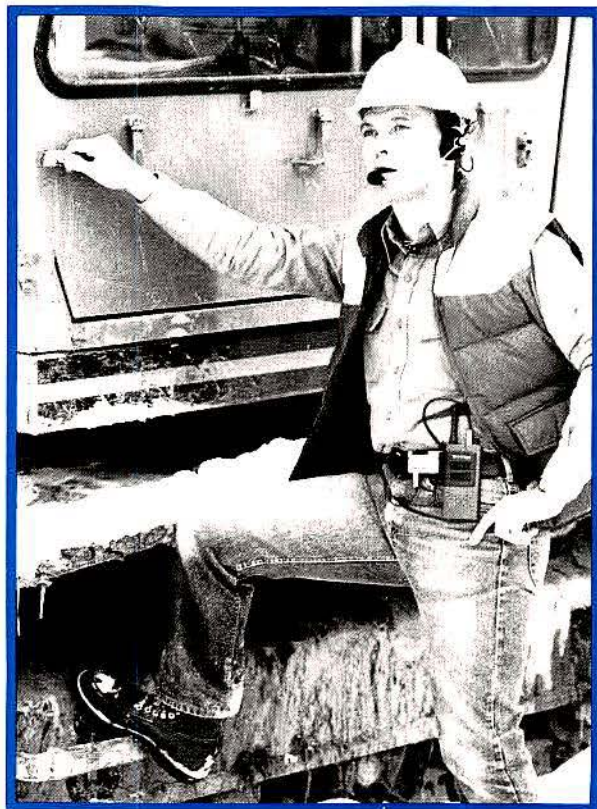
- NO BATTERIES REQUIRED
- NO RADIO MODIFICATIONS
- PLUG COMPATIBLE FOR MOST MAJOR BRAND 2-WAY RADIOS

CONTROLONICS CORPORATION

6A LIBERTY WAY
WESTFORD, MA 01886

800-233-8639

In Massachusetts Call (617) 692-5434



Call For The Dealer Nearest You



*"Multiplier offered me the
highest quality battery packs
and same day shipment..."*

*That was 13 years ago
when I was their first
customer. I'm still their
customer and they still
have the highest quality
batteries and same day
shipment...*

*I don't know of a
better supplier in the
industry!"*

Herb A. Rosenberg

Herb Rosenberg
MOBILE COMMUNICATIONS SERVICE
Bridgeport, CT

Circle (40) on Fast Fact Card

Multiplier®

Multiplier Industries Corp.
135 Radio Circle, P.O. Box 630, Mt. Kisco, NY 10549
In NYS: 914-241-9510 Outside NYS: 800-642-2424
Telex: 4932483 MULTUI FAX: 914-241-1103

Ora secures temporary restraining order

Ora Electronics, Chatsworth, CA, has obtained a temporary restraining order against TCC Enterprises, a California company; Cellular International, a division of TCC; Cellular Antennas, Mounts and Accessories, a California

corporation; and two individuals. The order restricts the companies and individuals from marketing and distributing products and literature that Ora alleges infringe on its copyright.

Motorola sales increase in first quarter

Motorola, Schaumburg, IL, reports growth in sales and earnings in the first quarter of this year. First quarter sales are up 26% from a year earlier. Earnings increased 88 cents per share compared to the same period last year. New orders in the Communications Sector set records for any quarter in the company's history.

First quarter sales in the Communications Sector advanced 25%, orders increased 14% and backlog at the end of the quarter was 21% higher than a year ago. Worldwide demand increased for paging products and advanced two-way systems.

Glenayre posts sale to Paging Network

Glenayre Electronics, Vancouver, British Columbia, has sold a networked, multiterminal paging system to Paging Network, Dallas. The equipment, intended for installation at Paging Network's Los Angeles system, uses the Telocator networking paging protocol.

Telular patent covers radio interface

A second U.S. patent, No. 4,737,975, has been issued to Telular, Skokie, IL, as a continuation in part to the company's original patent for a cellular-type radio interface. The new patent covers the programmable functions of the tip and ring to the radio interface, which enables the connection and normal use of wireline telephone equipment, including auto dial and auto answer features. The company expects a third patent to be issued shortly, which will add further to the scope of the underlying invention.

AmeriCom receives venture capital funds

AmeriCom, Atlanta, has received an additional \$3 million of venture capital funding to accelerate production and marketing of its network switch and mobile controller. When combined with mobile controllers, the network switch allows SMR operators to offer integrated radio and telephone services in individual mobile units. AmeriCom began direct shipment of its network switch late in 1987 and is marketing them directly through Uniden Corporation, Dallas.

OE OPTOelectronics

1.3 GHz Frequency Counters



#8013-S
\$499⁰⁰

- Deluxe lab quality
- 10 segment LED bar graph
- 10 MHz external clock
- 4 gate times, 9 digit resolution to 175 MHz

#1300HC
\$150⁰⁰

- Pocket size
- 8 LED digits
- 2 gate times
- AC/DC operation
- Antenna not included



TESSCO™

Your Total Source®
DIRECT ORDER HOTLINE
800-638-7666
Touch 2

GO8

Circle (41) on Fast Fact Card

ABRACADABRA



We did it! The Model NC-105 Digital Coded Squelch Encoder/Decoder. Designed specifically for squelch control applications and compatible with both Motorola's DPL and General Electric's DCG systems.

The NC-105 features SMT, micro processor circuitry, over 150 field programmable codes, and NorComm's assurance of technical assistance on most

applications.

Imagine all that power packed into a mini 1.25"W x 1.60"L x .25"H package. Complete with the superb quality NorComm is renowned for.

Through a bit of wizardry on our part, we're introducing it at a price that can't be beat. As low as \$76.45 (dealer net). Some may call it magic. We call it the NorComm Model NC-105.

NORCOMM
TONE SIGNALING PRODUCTS

TOLL FREE SALES 800-874-8663 / In California Call (916) 477-8400 / FAX (916) 477-8403
12438 Loma Rica Drive "A" / Grass Valley, CA 95945

Circle (42) on Fast Fact Card

Kustom earnings continue on an upward scale

Kustom Electronics' second quarter earnings for a period ending April 1 were 12% higher than those for the same period last year. The Lenexa, KS-based company recently signed an agreement with Philips Radio Communication Systems of Cambridge, England, for distribution of Kustom's mobile digital terminal systems in the United Kingdom. The arrangement is expected to enhance Kustom's presence in the international communications marketplace and contribute to its continued upward growth.

Johnson, Insosafe expect fall delivery of radios

E. F. Johnson, Waseca, MN, and Insosafe, Tucker, GA, report their Challenger/SafeTalk secure radios will be ready for fall delivery. Under the joint development, the Challenger/SafeTalk radios incorporate a voice scrambling technology for secure transmissions.

Neulink appoints two area representatives

Holtzberg, Totowa, NJ, and Kemp Engineering, Addison, TX, have been appointed area representatives for the Neulink division of Celltronic, San Diego.

CES relocates

Communications Electronics Specialties has relocated to a larger office and manufacturing facility. The company's new address is CES, 931 S. Semoran Blvd., Suite 218, Winter Park, FL 32792; 407-679-9440; 800-327-9956.

Page New York expands answering service

Page New York, Schenectady, NY, has acquired Answering Services, Saratoga Answering Services, South Saratoga Answering Services and Reliable Answering Services, all based in upstate New York. With the acquisitions, Page New York becomes the largest provider of telephone answering services in the area.

The expanded service area includes Albany, Schenectady, Troy, Glen Falls, Saratoga, Clifton Park, Colonie and surrounding towns. The company is installing state-of-the-art technology and will offer voice mail service.

Marconi adds System Sales

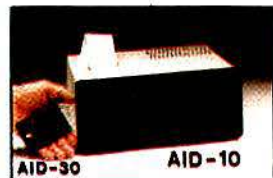
Marconi Instruments, Allendale, NJ, has added System Sales, Hudson, MA, to its list of representatives of Checkmate and In-Circuit ATE systems.

It will bring in the clowns.

Automatic Vehicle ID

This low cost system is guaranteed to stop the horseplay. No more anonymous callers or searching for the stuck mike. With this ANI system the dispatcher will know the vehicle number immediately. And no annoying tones for the dispatcher. The AID-30 encoder mounts in vehicle radio and automatically transmits ID number with a very short, 100-msec. burst. Has stuck-mike feature and time-out timer.

The AID-10 decoder provides the dispatcher with a display and printout of vehicle ID, date and time of each call. Vehicle emergency-status decoding and color monitor display are optional.



Fleet prices: ID-27 \$69 (100 qty.); AID-10 \$3404. Full one-year warranty.

GSC CONTROL SIGNAL CORPORATION

1985 South Depew, Unit 7 • Denver, CO 80227 • (303) 989-8000



OPTIONAL COLOR MONITOR SHOWN

Write for brochure or call toll free 1-800-521-2203.

Manufacturers of Automatic Number Identification (ANI) Systems, The Tone Monitor Timekeeper™, and Morse Code Station Identifiers.

Radio equipment market enjoys favorable outlook

The equipment market for two-way land mobile is solid and growing, according to a Frost & Sullivan report titled "Mobile Two-way Radio Market in the U.S." The report indicates new product opportunities are at hand for suppliers of two-way mobile equipment, particularly 900MHz band equipment. The growth is attributable to increasing user

demand and more licensees. The major growth spurt is expected to come between 1988 and 1991, according to the study from the New York-based research company.

The predicted growth spurt stems from the FCC's allocation of blocks of additional spectrum to private radio services in 1986. Parceled out were 120

pairs in the 800MHz frequency band and 399 in the 900MHz band, the highest frequencies for land mobile use.

The study forecasts license authorizations to increase from an estimated 1.367 million in 1987 to 1.797 million in 1992. The number of mobile and portable users is expected to grow from 6.297 million in 1987 to 8.412 million by 1992.

New-unit sales of radios are anticipated to number 294,000 in 1988 and jump to 415,000 in 1989, with an expected peak at 589,000 in 1991. Sales of new units in 1992 are forecast to drop to 339,000.

The report analyzes technical factors, the competitive environment, individual manufacturers, carriers, systems, end-users and general market considerations. Copies of the report are available from the company.

Public safety group seeks open architecture

Last fall, the FCC and the National Public Safety Planning Advisory Committee (NPSPAC) completed a nationwide public safety plan for mobile radio communications. The plan provides additional radio channels, which, together with trunking technology, is expected to eliminate many communications problems police and other emergency units encounter.

Open Architecture Radio for Public Safety (OARPS) sees a problem with the new technology—a problem not of busy signals, but of higher costs.

OARPS founder Gary Hampton says the new safety plan should require a nationwide standard for trunking technology that would guarantee the same brand-to-brand compatibility that cellular phone users enjoy. In the group's "Call to Action" document, Hampton cites two problems with incompatibility:

- Because mobile radios only operate within their own brands, manufacturers can build fences around their own "turf," thus causing price gouging.

- Incompatibility hinders the development of technology in the long run because many vendors will not develop new products if they cannot be worked into the current "fenced-in" system.

OARPS wants to use free-market forces to develop one architecture standard, and then ask the FCC to adopt the

THE SOUND SOURCE

FOR

- ★ Cellular Antennas ★
- ★ Indoor & Outdoor (Weatherproof) Amplified Extension Speakers ★
- ★ 4 & 8 Ohm Professional Communication Speakers ★
- ★ High Power P.A. Horns ★
- ★ Portable Power Megaphones ★
- ★ Hand Held Microphones ★
- ★ Electronic Alarms & Sirens ★
- ★ Marine ABS Plastic Horns ★
- ★ Digital & Analog Multitesters ★
- ★ OEM Miniature Speakers ★
- ★ 12 Volt D.C. P.A. Amplifiers ★








OUR 28th YEAR

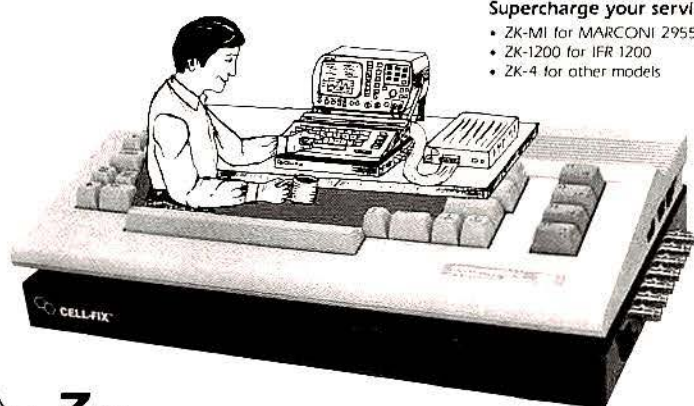
SPECO

Division
COMPONENTS SPECIALTIES, INC.

1172 Route 109, P.O. Box 624 • Lindenhurst, New York 11757
Call Toll Free 800-645-5516 • In New York State 516-957-8700
TELEX: 96-7754 SPECO LNST • FAX: 516-957-9142

Circle (44) on Fast Fact Card

CELLULAR TESTING POWER at the touch of a key!



Supercharge your service monitor!

- ZK-M1 for MARCONI 2955/2957
- ZK-1200 for IFR 1200
- ZK-4 for other models

ZK CELLTEST SYSTEMS

108 E. Fremont Avenue, Suite 80 • Sunnyvale, CA 94087-3201 • (408) 735-7076

Circle (45) on Fast Fact Card

These save lives.



This saves more.



No matter what kind of emergency vehicles you are responsible for, you can save time, manpower — and money — with some help from Magnavox. Because Magnavox AVLS uses advanced navigation technology and electronic mapping to let you see your fleet at a glance, and deploy it more efficiently.

A Magnavox AVLS is integrated to your communication system. The system polls for vehicle locations silently, and automatically, reducing voice traffic while it gives you a timely, accurate picture of the disposition of your entire

fleet. It uses two proven integrated positioning systems. And everything is automatic, so you can respond to emergencies faster and more efficiently.

When every second counts, you can't afford to be without a Magnavox AVLS.

To see how much the system can save you, contact Marketing Manager, NAV-COM, Inc., a subsidiary of Magnavox Advanced Products and Systems Co., 9 Brandywine Drive, Deer Park, NY 11729, Telephone (516) 667-7710, FAX (516) 667-2235.

Magnavox
Magnavox Advanced Products and Systems Company

Circle (46) on Fast Fact Card

standard. Members will be working on system interfaces between the mobile radio and the base station equipment, between the mobile radio and mobile data terminal equipment, between the trunking control equipment and computer aided dispatch equipment, and on voice encryption techniques.

Through standardization, OARPS hopes to enlarge the equipment choices

and system-to-system operability between federal, state and local public safety trunked systems using the 800MHz band and promote creativity and competition among the mobile radio companies.

OARPS and its board of directors are not associated with any manufacturers. Besides Hampton, who is a land mobile consultant, the other founding directors

are Rick Woodsome, a public safety consultant; Donald D. Kavanagh, a management consultant and director of projects for APCO Project 16; Craig Jorgenson, the director of telecommunications for Utah; and Robert Fenichel, with the National Communications System, Office of Technology and Standards and chairman of the Federal Telecommunications Standards Committee and land mobile subcommittee.

Commonwealth, CTI, Telacast begin joint marketing effort

Commonwealth Communications Industries, Ashland, VA; CTI, Corinth, MS; and Telacast, Euless, TX, have launched a joint marketing effort. The three companies are distributing their products collectively through the same group of manufacturers' representatives. Ted Faust, Commonwealth's vice president of sales and marketing, administers the program.

The joint marketing arrangement brings paging, mobile telephone and voice mail equipment together for presentation to prospective customers.

York College awards honorary degree to Link

The "father of mobile radio," who gave FM radio technology to police and the military, has been given an honorary degree for his work.

On May 14, York College of Pennsylvania awarded Fred M. Link, MRT's industry consultant, a Doctor of Humane Letters degree in recognition of his contributions to the art of radio communications.

Link, who was born in York, graduated from Penn State University in 1927. In 1931, he established Link Radio, which engineered and manufactured radios used by police. Soon Link was collaborating with other industry leaders in developing the first FM radios used in combat by the U.S. Army.

Link Radio was sold in 1950, and Link became operations director for the communications department of Allen B. DuMont Laboratories in 1954. Later, he joined RCA's Mobile Radio Division as a communications consultant. Since 1966, Link has been a land mobile radio communications consultant.

"It's Big. It's Ugly. It's Expensive. But...It Performs."

“Our original 800/900 MHz base station antennas barely got our signals into the top floors of Denver's high-rise buildings,” recalled Jeff Levy, president of Mobile Telecommunications, Inc. (MTI). “So we started experimenting. Most of the antennas we tried shot most of the signal straight out to the horizon—right over the top of Denver and out toward the Kansas border—not exactly MTI's primary service area. Even antennas with -3° beam down tilt missed.”



Jeff Levy, President, Mobile Telecommunications Inc.

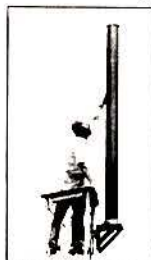
Bogner to the rescue. Levy unhesitatingly credits Bogner side-fed cardioid antennas

with solving the primary coverage problems. “They're ugly, they cause unreasonable wind loading and they cost twice as much as antennas we had been using. **BUT THEY PERFORM!** We're delivering 900 MHz into subbasements in buildings whose top floors we couldn't even touch with other antennas.”

FAIRPLAY reprint June 1986

Bogner Antennas Put Your Money Where Your Signal Is

A Bogner antenna costs more. It's bigger than most. And it will never win a beauty contest. But it puts your signal right where it belongs; like no other antenna can. At 900-MHz, Mobile Telecommunications Inc. needed eight transmitting sites, five on mountain tops and three on downtown buildings. Startup MTI had to carefully watch its costs in equipping these sites. Yet it chose a more expensive antenna. Why? Because the best place to boost overall system performance is at the antenna. Dollar for dollar, money spent on the antenna boosts performance more than money spent anywhere else. More than money spent on transmitting or receiving equipment.



BOGNER
Broadcast Equipment Corp.

Considering how expensive antenna sites are, doesn't it make sense to mount the best possible antenna at your site?

No other antenna performs like a Bogner. At any price. Its unique non-collinear design, using side-fed dipoles, lets Bogner mold its antenna pattern to your terrain. With just the right combination of horizontal gain and constant beam tilt, Bogner's patented reflector predictably directs your signal. Guaranteed. Every antenna is fully tested, not just representative samples that are like the one you order; so every Bogner antenna is guaranteed to perform as promised. Remember, when your signal absolutely has to be heard at ground level and below, Bogner antennas perform.

Now also available in 450 MHz models.

603 Cantiague Rock Road, Westbury, N.Y. 11590 • Telephone (516) 997-7800

All he knows is it doesn't work. He doesn't care why. We do.

If his radio doesn't work your reputation goes on the line. And so does ours.

That's why we work so hard to make sure our batteries are the best they can be prior to shipping. In fact, Alexander batteries are guaranteed to hold 80% of their original rated capacity after one year. And our Lexstar battery line is guaranteed 90% capacity.

What's more, you'll find our team of more than 35 full-time battery specialists are in the field to handle any questions or problems...person to person...with the attention you deserve.

You'll also like our speedy delivery. Our network of ten stocking warehouses keep most batteries in stock, ready to ship at a moments notice. We've been giving radio service managers like you the personal service they deserve for more than 20 years.

After all, we're out to help you...and your reputation.



Alexander Batteries™

By Alexander Manufacturing

P.O. Box 1508, Mason City, IA 50401
1-800-247-1821 or 515-423-8955

Norm Rizzo wins \$1,000 'Case of Cash'



Norm Rizzo, of R. Radio, Benton Harbor, MI, accepts the \$1,000 "Case of Cash" from staff editor Jane Bryant. Rizzo spent some of his winnings at Expo '88, where the contest was held.

Norm Rizzo, owner of R. Radio, Benton Harbor, MI, won \$1,000 in *MRT's* second annual "Case of Cash" giveaway. The contest was held during April's Expo '88 trade show in Las Vegas, NV. To qualify for a chance in a drawing for the cash, contest participants completed as many as eight different questionnaires. Answers to the questions were available from exhibitors; only correctly completed questionnaires were placed in the drawing.

Although only one questionnaire was needed to enter, Rizzo completed eight different questionnaires correctly, giving him eight chances in the drawing. During a drawing held on the last day of the convention, one of his entries was drawn, and *MRT* staff editor Jane Bryant handed him a briefcase filled with 1,000 \$1 bills.

Rizzo, who has been in the industry 24 years, took some of his winnings back to one of the booths he visited to obtain a questionnaire answer. He

Need a Cellular NAM Programmer?

Profit from the Curtis Advantage

From
\$995⁰⁰
options addl.



Exclusive features give you the edge:

- All NAMs, all phones, even non-standard models!
- FREE printer* for accurate record
- FREE loaners, newsletters
- Timely updates and low-cost NAMs

Don't send your customers to your competition... **CALL NOW: (800) 332-2790.**
In CA: (415) 964-3846, FAX (415) 964-3574

* while they last

Curtis Electro Devices, Inc.

1235 Pear Avenue
Mountain View, CA 94043

Circle (49) on Fast Fact Card

RF MILLIVOLTER™



RF-801

20kHz to 1.5GHz
300 Microvolts to 100V
Circuit Loading <2 pF
\$675 complete w/probe

407/777-1440 800/327-9308
FAX: 407/777-1447
TELEX: 362837 (Helper UD)

HELPER INSTRUMENTS COMPANY
P.O. Box 3628
Indialantic, Florida 32903 USA

Circle (54) on Fast Fact Card

SAVE MONEY!

**CALL
FREE**



1-800-237-3063

7 A.M. TO 5 P.M. MON-THURS
(IN CONTINENTAL U.S. EXCEPT FL)

**FOR ALL YOUR
CRYSTAL
NEEDS!**

General Communication
Industry • Marine VHF
Amateur • Scanners
CB Standard & Special
Microprocessor

**GET YOUR FREE
1988 CATALOG**

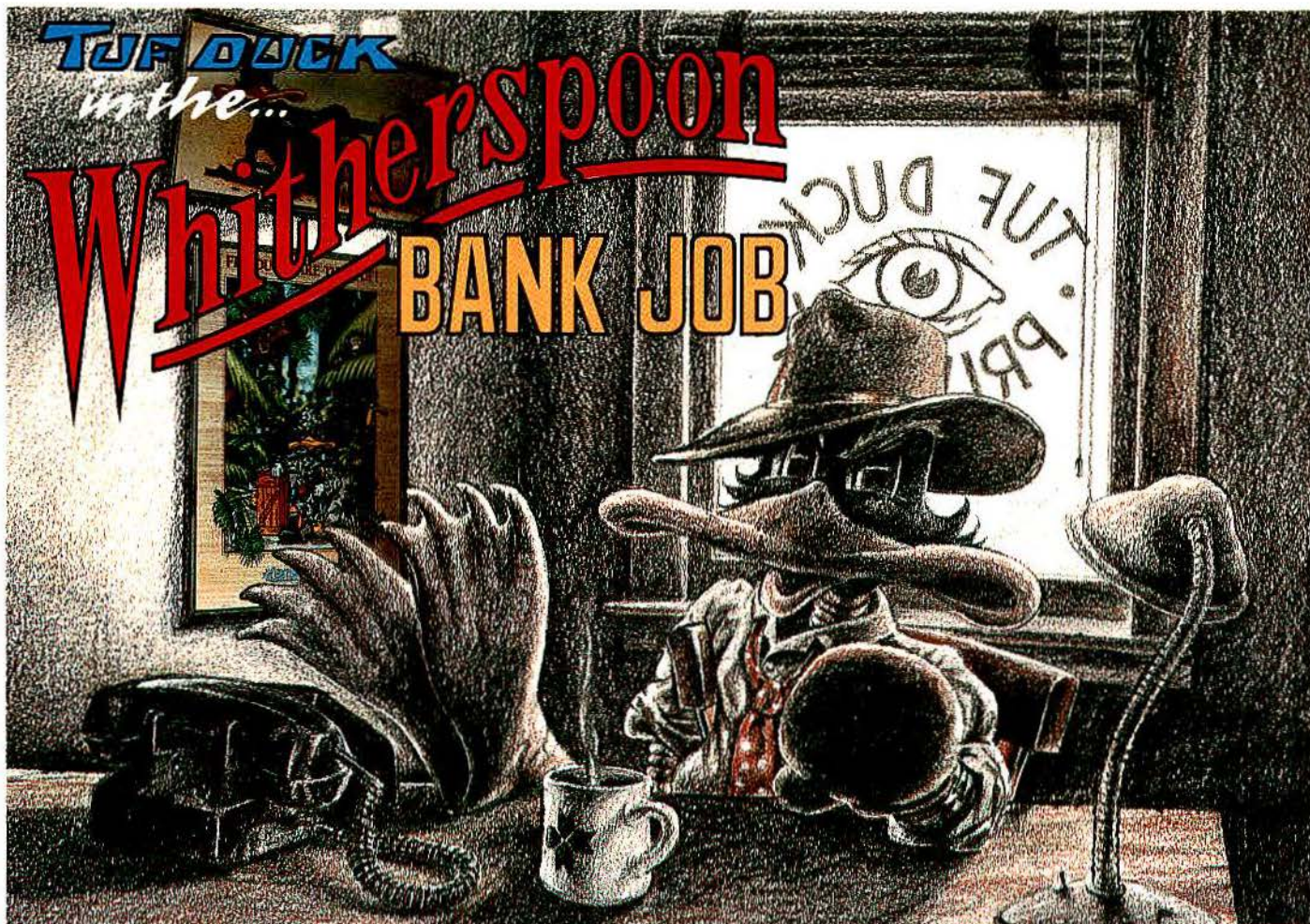


Call or write:
JAN CRYSTALS
P.O. Box 06017
Fort Myers, FL
33906-6017
FAX: 813/936-3750

SINCE
1965



Circle (51) on Fast Fact Card



The phone rang at 3:15. It was Friday, and Mrs. Whitherspoon, who owned the bank and a good bit of the city to boot, had arranged a party. She wanted us to be there.

I grabbed a new Centurion battery pack for my radio and got ready to do my job.

Money had been disappearing from Mrs. Whitherspoon's bank, and she suspected one of the tellers, whom she had invited to the party. Also at the party were a florist, a judge, an interior decorator, a fisherman, and a used car dealer.

According to their nametags, the people at the party were Mr. Barnaby, Mr. Cranston, Mrs. Holmes, Miss Jamrock, Mr. Montrose, and the ever-lovely Miss Pennyworth.

Mrs. Whitherspoon had given us the following information:

The judge is the florist's grandson; the interior decorator is the fisherman's son-in-law; Mr. Barnaby is a bachelor; Mr. Cranston is 19 years old, and a freshman at the university; Miss Jamrock plays tennis with the teller; and Mr. Montrose is the florist's neighbor.

Our job: Keep an eye on the teller; and on the interior decorator, who has his lustful eye on several of Mrs. Whitherspoon's finest antiques.

©Copyright 1988 Centurion International, Inc.

Our deal: You get involved. You give us the names of the people we need to keep under surveillance — the teller and the interior decorator.

Then we show our appreciation for your fingering the right people (as determined by our judges, of course — it's the American system of jurisprudence).

If you are one of the first 50 people (determined by postmark) to correctly tell us the names of both the teller and the interior decorator, we'll send you a certificate attesting to your unparalleled perspicacity as a private investigator, and entitling you to a tenth item absolutely free when you order nine of the same kind from Centurion International.

So get on the stick and send me those names right away. And if you do a good job this time, we might call on you again sometime.

CENTURION

INTERNATIONAL, INC.

P.O. Box 82846 • Lincoln, Nebraska 68501 • U.S.A.

800/228-4563 • In Nebraska 402/467-4491

FAX # 402/467-4528 • Telex 48-4377 CENTURION LCN

**10th
YEAR**

Mail your entry to Centurion International, P.I. Division, P.O. Box 82846, Lincoln, NE 68501.

Hey, Tuf Duck! These are the people you need to watch:

The teller is: _____

The interior decorator's name is: _____



Send the Certificate to:

Name _____

Street/Box _____

City _____ State _____ Zip _____

Circle (52) on Fast Fact Card

bought a set of FCC rules and a subscription to a rules update service from Rules Service Company.

Rizzo said he visited at least six companies' booths in connection with the contest that he otherwise would not have visited, and did business with several of the companies.

"The contest really worked," said Rizzo. "I learned valuable information and made some new business contacts as well."

Selectone acquires Airwave

Selectone, a Hayward, CA, manufacturer of tone signaling and remote control equipment, has acquired Airwave, Ft. Worth, TX, a manufacturer of microprocessor-based DTMF decoders for selective calling and remote control. Selectone plans to move the Airwave operation to Hayward and to offer the Airwave product line from the Hayward factory or from distributors.

Airwave was founded in 1984 by Paul Brown and Russ Miller.

Former managers buy SilCom assets

Two of Kanata, Ontario-based Siltronics' former managers, Peter Williams and John Rivenell, formed Leyton Technology to purchase the assets of the company's radio pager division, SilCom. The management buyout was completed March 29, and the new company that resulted is called SilCom Communications Inc., based in Nepean, Ontario.

Equity financing for the company was completed with financing from private sources, as well as a 20% stake from Innovations Ontario Corporation, a provincial government company that funds startup businesses.

Rivenell heads the newly formed company as chairman and vice president of operations. Williams is president and vice president of marketing and sales.

The new company has moved to production facilities in Ottawa, Ontario, and since taking over the paging division, orders of more than \$500,000 for exist-

ing paging receivers have been placed. The new address is SilCom Communications, 38 Antares Drive, Suite 400, Nepean, Ontario, K2E 7V2, Canada; 613-723-2226.

Motorola features traveling technology exhibit

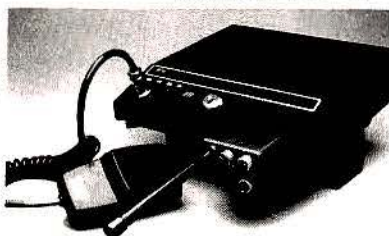
The Winds of Change '88, Motorola's traveling technology exhibit, this month is winding up its cross-country trek, with its last scheduled city in Chicago, Aug. 24. Prior to Chicago, the exhibit will be in Santa Clara, CA, Aug. 4. The exhibit features two-way radio communications and advanced communications solutions and applications.

Included in demonstration are wide-area trunked radio communications; on-premises communications; automatic vehicle location; control and dispatching; secure voice products and systems; and point-to-point, point-to-multipoint and alarm and control systems designed for security monitoring.



Available
NOW

MOBILE ADAPTER FOR THE KING PORTABLE



FEATURES:

- BUILT IN R.F. AMPLIFIER
- BUILT IN AUDIO AMPLIFIER
- EXTERNAL AUDIO JACK
- FAST CHARGER
- ALL CONNECTIONS MADE WITH ONE SLIDING LEVER.
- CONSTRUCTED TO COMPLIMENT THE KING RADIO LINE.

PRODUCT SPECIFICATIONS

R.F. Amplifier:	35 Watts VHF, 20 Watts UHF, 20 Watts, 800MHZ
Audio Amplifier:	8 Watts to External Speaker Jack, 5 Watts to Internal Speaker
Charger:	Automatic Thermal Sensing, 3 Hour Fast Charge, Normal Charge
Input Voltage:	12.2 VDC to 15.0 VDC
Current Drain:	5 Amps when Transmitting
Connections:	Automatic through Sliding Contact Block
Dimensions:	8"W x 2 1/4"H x 9 1/2"D
Weight:	3 Pounds
Operating Temp.:	-30° to +60°C
Indicators:	Led Indicators for Audio On, Fast and Normal Charge, R.F. On
Security:	Keylock
Microphone:	Optional

Leadership by tradition.

TPL

COMMUNICATIONS, INC.

3336 SAN FERNANDO ROAD
LOS ANGELES, CALIFORNIA 90065
(213) 256-3000
800 HI-POWER
TWX: 910 346 7015
FAX: 213-254-3210

Available
NOW

Circle (53) on Fast Fact Card

TRYLON ABC Towers

A low cost alternative for two-way communications

- 96' self support, delivered to your door for \$1300
- Designed to meet your unique requirements
- Rugged, dependable triangular construction

Give us a call



TRYLON

Manufacturing Co. Ltd.

P.O. Box 186
21 Howard Ave.
ELMIRA, Ontario
Canada N3B 2Z6

TEL. (519) 669-5421

FAX (519) 669-8912

Delivery included to most major centres in the continental U.S.

Circle (90) on Fast Fact Card

Can You Really Identify Who's Transmitting?



DIGITAL UNIT IDENTIFICATION is the industry standard adopted by General Electric and Motorola to positively identify mobile and portable transmitters in public safety, fire, government, business and industrial radio systems. Only Coded offers full compatibility with these standards.

SUPERIOR SIGNALING RELIABILITY

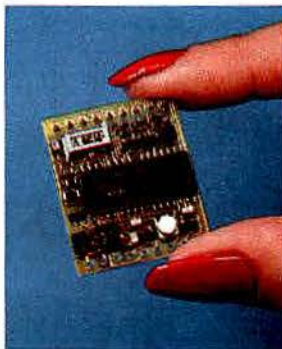
Digital PSK modulation is employed in combination with powerful error detection and correction protocols to provide superior accuracy and reliability. Coded's automatic transmitter identification encoders and decoders typically exceed 99.99% signaling reliability at signal-to-noise ratios too low to support effective voice communications.

FAST AND ACCURATE

In less than a third of a second the entire four digit identification burst is transmitted, received, error detected, corrected and displayed. This is less time than it takes to send four simple DTMF tone digits without the benefits of error detection and correction.

COMPLETE SYSTEMS CAPABILITY

Coded's full line of products are compatible with existing radio equipment to meet the needs of both large and small systems. Our sub-



miniature encoders are designed to fit the smallest portable and mobile equipment and are easily installed. Coded's status display system, shown above, provides dispatchers with an efficient cost effective solution for fleet status monitoring. Our system controllers are designed to interface with complex CAD systems and can accommodate the largest public safety fleets.

FIND OUT WHY CODED IS BEST

Let Coded identify solutions for your requirements and discover why Coded is the leader in transmitter identification products.

Coded
communications

2375 Camino Vida Roble, Carlsbad, CA 92009
Nationwide 800 228-6368 / California 800 325-0147
TELEPHONE 619 744-3440

Circle (55) on Fast Fact Card

NABER boosts membership services and programs

The National Association of Business and Educational Radio (NABER), Alexandria, VA, has begun developing new directories, seminars and publications in response to a business radio user survey it conducted. A few months ago, the association made several improvements in its business radio frequency coordination service. This latest round of improvements to upgrade membership benefits was approved by the association's board of directors when it met during NABER's 23rd Annual Meeting, March 6-9, in The Woodlands, TX.

Membership sections

The association's membership is divided into four sections:

- (1) The user section.
- (2) The professional mobile radio service section (PMRSS).
- (3) The specialized mobile radio (SMR) section.
- (4) The Association of Communications Technicians (ACT) section.

New services and programs include:

- A directory of all user-section, PMRSS- and SMR-section members.
- A directory of all ACT-section members.
- Four regional educational seminars for SMR operators.
- Four regional educational seminars about private carrier paging.
- Quarterly technical supplements to ACT's "Techtalk" newsletter.
- Quarterly supplements to the SMR section's "SMR Letter."

The board also voted to maintain annual membership dues at current rates:

Users: \$40
PMRSS: \$80
SMR section: \$125
ACT section:
\$30 (general)
\$35 (senior)

The technician certification exam fee remains at \$40.

The board approved a reduction of one of NABER's most controversial fre-

quency coordination fees from \$500 to \$385. The fee covers frequency coordination for private carrier two-way systems; non-profit, cost-sharing cooperative; and 800MHz conventional SMR systems. The reduced fee is effective for applications received at NABER on or after April 1, 1988.

Recertification

The board approved establishing three alternatives for re-certifying NABER certified technicians, including those with "grandfather" certificates and those who have taken the certification exam:

Paper renewal—A current certificate or a copy of it may be turned in, together with the \$40 fee, and a new, five-year certificate will be issued.

Testing—Anyone may take the certification test, for renewal or for a first-time certificate. Successful candidates are issued a five-year certificate.

Continuing education—NABER will

You Liked the PK-80? You'll Love the PK-90!

- Data rates from 1200 baud, dependent on channel bandwidth
- Easy datalink trouble shooting with remote control of PK-90 by radio
- Password access ensures system security
- SMR operation with trunked radio interface
- Built-in data encryption for security-sensitive applications
- Easy operation using user-programmable macro keys
- Host computer control language
- 12 VDC power allows portable or mobile operation
- Easy connection to your computer and radio
- 2400 baud and -40 degree C options

The PK-90 replaces the PK-80 Packet Radio Controller and brings you the above features NEW TO PACKET. Applications range from remoting a computer terminal through a radio link to control of distant equipment using the PK-90 with inexpensive SCADA controllers. You can coexist on a simplex channel with other voice or data users. Data is error-free, and the untrained user can learn station operation quickly. A station can cost less than \$1000. JUST CALL AND ASK!!

Ask about the PK-232 and PM-1 for SSB data transmission.

Your imagination is the only limit. Call John Gates, or circle the reader service number, DEALER INQUIRIES INVITED.

Advanced Electronic Applications Inc.

P.O. Box C-2160, Lynnwood, WA 98036
(206) 775-7373 Telex: 6972496 AEA
INTL UW Fax: (206) 775-2340



Add the Finishing Touch . . .

You Already Own 75% of a Packet Radio Station!

Add a PK-90 Packet Radio Controller and Send Any Text or Data, Error-Free, to a Remote Screen, Disk, or Printer.





The R-2001D. Opening new doors with 4 key options.

The versatile Motorola R-2001D Communication Systems Analyzer with 16 integral test instruments and its four key options steps you through new doors to business opportunities in Cellular Signaling; Motorola 806-Band Trunking;

Secure Communications; and IEEE-488/RS-232 remote control. Options that keep up with rapidly changing technology, improve your response time, and maintain your accuracy and quality of repair. For the best in quality,

selection, price and delivery that opens the doors, call **toll free 800/367-2346, extension 82.**

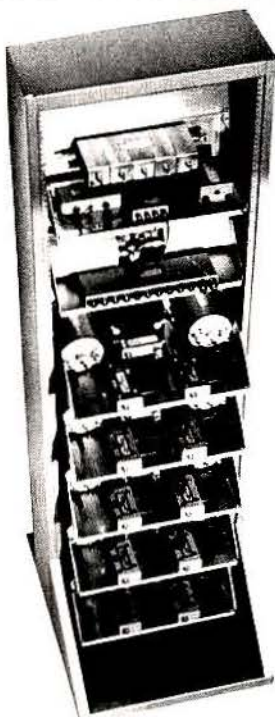


MOTOROLA

INTO 900 MHz. TRUNKING ?

EMR has the FIELD PROVEN antenna system combining package for you!

During the past 10 months, we have delivered more than 500 channels of 900 MHz. transmitter combining and receiver multicoupling. The first systems to go on the air in the U. S. use EMR's combining equipment. We learned from field experience what others are still working on in their development programs. We offer proven 900 MHz. system performance. Remember, your system will work only as good as the antenna combining package that supports it, no matter what make of radio equipment you may select! Contact us today for full information.



A 10 channel 900 MHz. transmitting-receiving combiner system

EMR CORPORATION

22402 N. 19th Avenue
Phoenix, AZ 85027

Tel: (602) 978-5766
or 581-2875

Circle (58) on Fast Fact Card

Regulating technology

renew certificates held by technicians who complete lesson plans by correspondence. The association sends the renewal candidate five such plans. If the candidate completes three successfully, a new five-year certificate is issued.

Renewal certificates indicate whether they were obtained for a fee alone, as a result of testing, or as a result of the technician's completion of a continuing education program.

Board elections

Five board members were re-elected to new terms:

Minnie M. Adams, Mitchell Energy and Development, The Woodlands, TX, who also serves as chairperson;

William L. Detwiler, Helper Instruments, Indialantic, FL, who also serves as treasurer;

Karl Kachadoorian, IBM, White Plains, NY;

Leonard Kolsky, Motorola C&E, Washington, DC; and

Dale Walsh, SCADA, Irving, TX.

Two individuals were elected as freshman board members:

Jack Farrell, General Electric, Lynchburg, VA; and

Russell S. Lewis, Syntonic Technology, Harrisburg, PA.

They join the following to compose the 1988-89 NABER board of directors:

F.G. "Spike" Fuson, Communications Engineering, Las Vegas, NV, who also serves as vice chairman;

James B. Moore, Federal Express, Memphis, TN, who also serves as secretary;

Richard Meyer, Meyer, Faller, Weisman & Greenburg, Washington, DC; who also serves as assistant secretary;

William Barnhart, Citicorp, St. Louis;

J.R. Bell, Bell Communications, Fort Worth, TX, who also serves as chairman of the SMR section;

David Ferrell, Shawnee, KS;

John Gilchrist, Gilchrist Plumbing, Oak Park, IL;

Fred G. Hamer, E. F. Johnson, Eden Prairie, MN;

Robert Howell, Yellow Freight Systems, Overland Park, KS;

Richard Inskeep, Sears, Roebuck & Company, Chicago;

Paul Klugerman, Caribbean Commu-

INTEGRATED TELEPHONE MOBILE RADIO COMMUNICATIONS CONSOLE



TRCC® integrates the call accelerating features of an electronic key telephone system with the complete capabilities of a radio remote controller.

Based on a completely distributed microprocessor architecture, TRCC® offers maximum flexibility. Custom configuration of each system to meet your communication needs.

Features include:

- Programmability
- Tone, DC, E&M Signalling
- Integrated Paging Encoder
- Mobile Decoders
- Multiple Patches
- Distant Operating Positions
- Binaural Headset Operation
- Integrated Speed-Dialer
- Programmable Ringing
- Modular Growth
- Reduced Cabling



POSITRON

Industries, Inc.

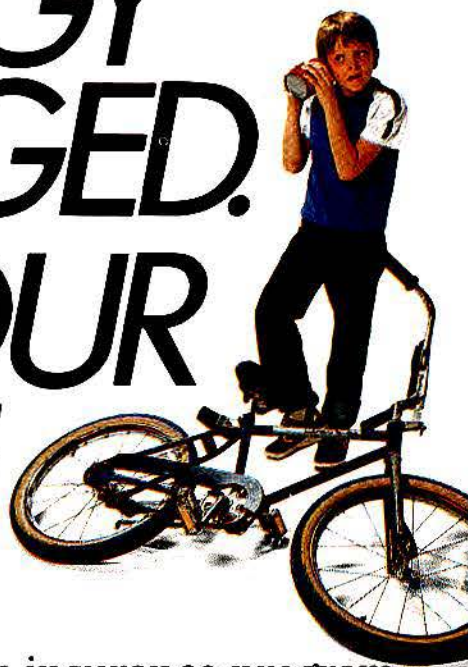
HEAD QUARTERS: 4810 JEAN TALON W. MONTREAL, QUE., CANADA H4P 2N5
TELEX: 05-825739 Fax: (514) 731-8662

Tel: (514) 738-2200

OFFICES: US: NEW YORK, N.Y. CANADA: TORONTO, ONT.

Circle (59) on Fast Fact Card

TECHNOLOGY HAS CHANGED. SO HAVE YOUR INSURANCE NEEDS.



Today, you need an insurance program that's in step with your business. One that can provide you with special coverages meeting the unique risks and exposures of your business. Along with the prompt, fair claim service you expect. You need Business Guard® from Royal Insurance.

For more than 15 years, Royal's Business Guard insurance program for the Communication Sales and Service Industry have combined custom-tailored protection with unmatched reliability. Business Guard also features a unique dividend plan, which last year returned to policyholders 10% of their premiums.*

While your industry continues to change, Business Guard's commitment to meet your special needs won't. For more on Business Guard, complete and return the coupon below.

Clip and mail to: Royal Insurance, 9300 Arrowpoint Blvd., Charlotte, N.C. 28217 Attn: CMM-CSS

Name _____

Title _____

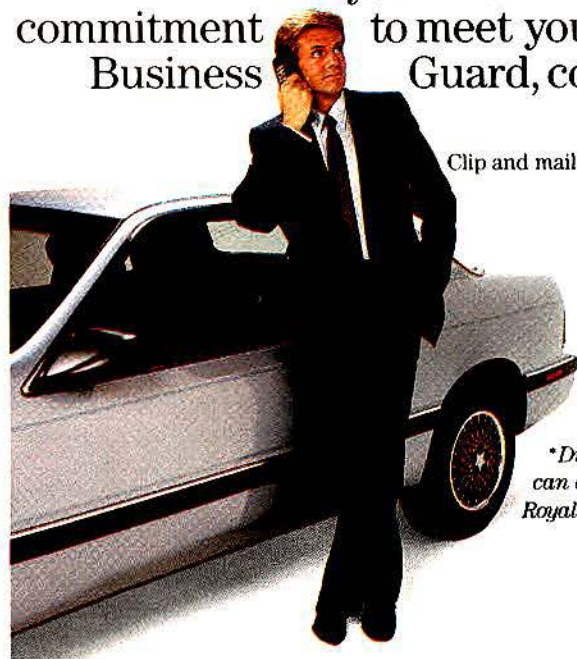
Firm Name _____

Address _____

Phone _____

Insurance Renewal Date _____

**Dividends cannot be guaranteed and can only be paid upon declaration by Royal's Board of Directors.*



Circle (60) on Fast Fact Card

The Complete Antenna and Cable Distributor

Communications Associates has been a leader in the wholesale distribution of mobile communications products since our founding in 1979 and today we are one of the largest distributors in the country.

Antennas, Cables and Connectors:

- Antenna Specialists
- Bogner
- Celwave
- Centurion
- Cushcraft
- Harada
- Maxrad
- Amphenol
- Andrew
- Cablewave
- RF Industries

Communications Associates Inc.

P.O. Box 2399 305 North Republic Avenue Joliet, IL 60434-2399
(815) 744-6444 US (800) 435-9313 IL (800) 892-1611

Regulating technology

nications, Miami, who also serves as PMRSS chairman;

Fred Link, Robin Hill Farm, Pitts-town, NJ (MRT's industry consultant);

John Linton, Linton Communications, Uniontown, OH;

Robert Marshall, McDonald's, Oak Brook, IL;

R. Wayne Nelson, Repco, Orlando, FL;

John Smith, Xerox, Rochester, NY, who also serves as chairman of the user section;

Judy Villastrigo, General Communications Engineering, Oakland, CA; and

Ian Wright, Dominion Communications Systems, Colonial Heights, VA, who also serves as chairman of the ACT section.

FCC amends microwave rules

Rules governing a microwave service used by some private radio system operators to link multiple sites have been amended by the FCC. The commission took the action in PR Docket 87-5, amending rules governing 900MHz multiple address radio system (MARS) operation "to make more efficient use of the spectrum, accommodate continuing growth, increase flexibility and reduce the current administrative burden upon both the FCC and the end-user," the regulatory agency's report reads. Changes include:

12.5kHz bandwidth—Channel bandwidth is set at 12.5kHz, a reduction from the previous 25kHz bandwidth. Licensees will be allowed to operate on wider bandwidths on a case-by-case basis. Current licensees on 25kHz channels may continue operations indefinitely on, in effect, two contiguous 12.5kHz channels. These licensees may consolidate their operations on one of the 12.5kHz channels and transfer the other, if they wish. They also may establish separate communications on the two channels.

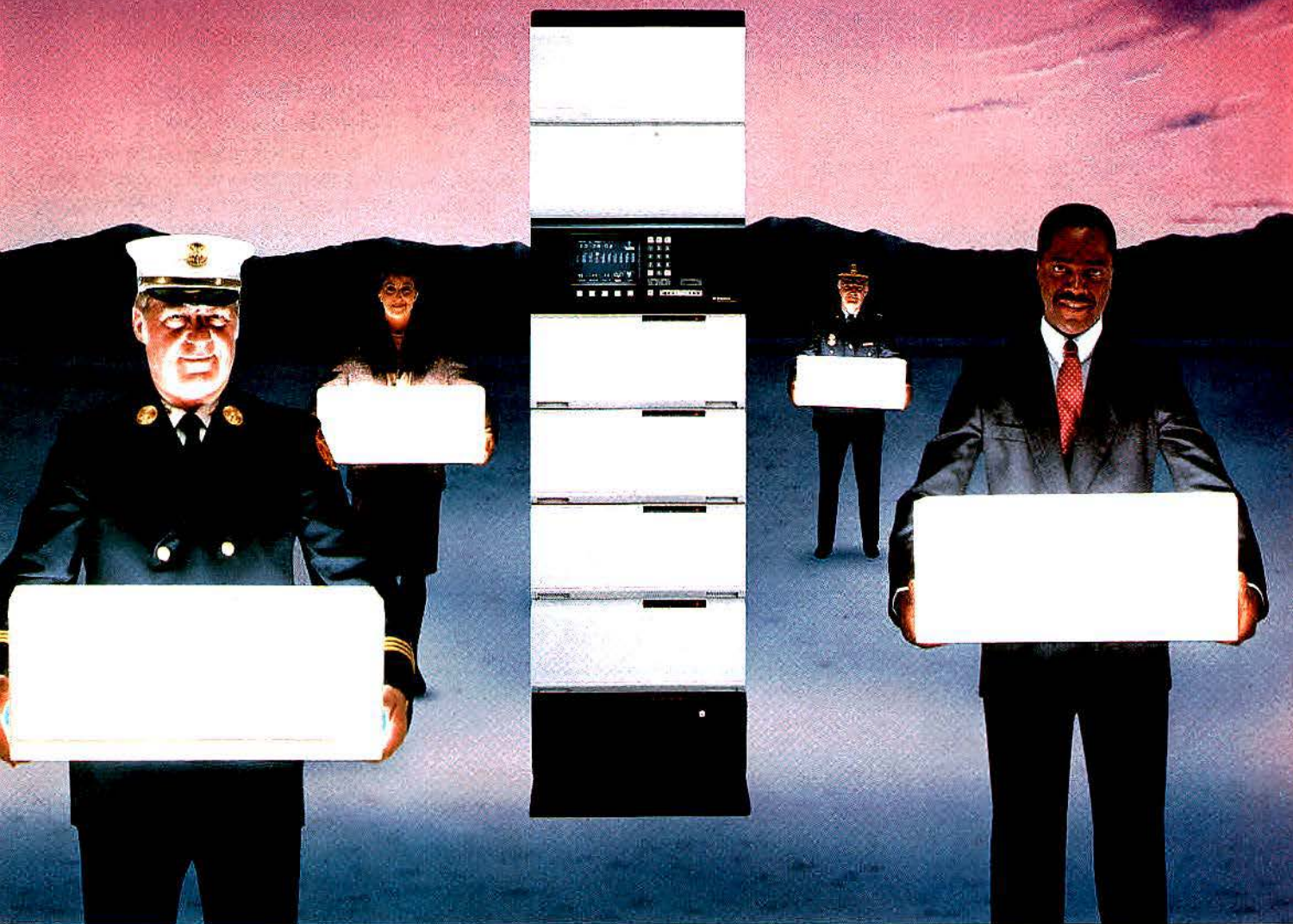
Frequency tolerance—Remote stations operating at the 12.5kHz bandwidth must adhere to a new frequency tolerance of 1.5 parts per million.

Mobile operation—Mobile stations may operate on unpaired MARS frequencies on a primary basis.

Master operation—Communications between master stations is permitted.

THE REST IS HISTORY.

INTRODUCING THE VERITRAC SERIES 9000
COMMUNICATIONS RECORDING SYSTEM.



Only Dictaphone Can Give You A Logger With Computerized Monitor Screens, Modular Flexibility And Up To 240 Channels.

The Veritrac 9000 is the ultimate recording system for business and financial applications, public safety, law enforcement, government agencies, transportation, industrial and private security. In fact, any organization that must maintain accurate records of all incoming and outgoing telephone or radio communications.

Only Dictaphone can offer you such features as a screen-based computerized command center. A capacity that can record 240 telephone and

radio conversations simultaneously. A centralized control panel. The most automatic microprocessor-driven features to ensure total fail-safe operation. And, unique modular flexibility. With works in a drawer and a compact footprint. To give you more capacity per square foot than any system of its kind.

When it comes to full service, Dictaphone offers more than 240 nationwide Service Centers.

As far as competitive logger recording systems? History.



Dictaphone

A Pitney Bowes Company

Circle (62) on Fast Fact Card

For more information and a copy of our free brochure, fill in the coupon or call toll-free: **SMRT 88**

1-800-342-8439

Mail to: Dictaphone Corporation
120 Old Post Road
Rye, N.Y. 10580-0648

Name

Title Phone **OR FAX TO: (814) 967-1479**

Company

Address

City State Zip

DICTAPHONE®, and Veritrac® are trademarks of the Dictaphone Corp., Rye, N.Y. © 1988 Dictaphone Corp.

Regulating technology

Interpool sharing—Currently, MARS frequencies are grouped into two pools, one for power radio service eligibles and one for all others eligible under Part 94 of the FCC rules. The commission decided to maintain the two-frequency pool concept. To ensure that frequencies assigned in one pool do not remain unused while the needs of users in the other pool go unmet, the new rules provide for interpool sharing beginning Jan. 1, 1992.

Mixed operation—The commission decided that paired frequencies should be used primarily for two-way requirements, but the ancillary one-way communication on a frequency pair would be permitted because it furthers the objective of increasing spectrum efficiency. Requests for one-way use on the paired frequencies will be addressed on a case-by-case basis.

Mileage separation—The FCC adopted a co-channel mileage separation of 75 miles.

Mobile satellite service is poised to win license

With the signing of a joint operating agreement, eight mobile satellite service (MSS) applicants have cleared the last obstacle between them and an FCC license to build, launch and operate an MSS system. The agreement, signed May 3, unites Hughes, Mobile Communications Corporation of America, McCaw, Mobilesat, North American Mobile Satellite, Skylink, Satellite Mobile Telephone and Transit Communications under the umbrella of the American Mobile Satellite Consortium as a single license applicant.


Public safety users seek more access to UHF-TV band

The California cities of Burbank, Compton, Glendale, Torrance and Whittier have petitioned the FCC for authority to use additional spectrum in the 470MHz to 506MHz band, which is allocated for UHF-TV broadcasting in most of the country.

The specific frequencies the cities seek are 19 frequency pairs among 24 assigned to radio common carrier use. The cities want the channels to be reallocated and justify their request based on their communications needs.

Seattle SMRs enjoy 105-mile protection

The FCC has increased the radius of interference protection for Seattle-area specialized mobile radio (SMR) systems on specific mountaintops from 70 miles to 105 miles. The action is expected to reduce interference between new co-channel systems on the affected mountaintops. It is retroactive only for those systems whose licenses were made conditional upon the outcome of this action while it was pending.

Seattle-area systems with sites below a certain elevation are not expected to suffer interference from co-channel systems more than 70 miles away, so for them, the 70-mile separation requirement remains in effect. 

Would You Trust Your Health to a Doctor Without an M.D.?

Would you trust your business to a two-way radio technician who wasn't certified?

NABER's Technician Certification Program assures employers and customers that technicians have the skill, knowledge and competence to do the job.

The NABER Certification Exam is a thorough test of a technician's abilities...and is quickly becoming the standard for measuring technician competence.

Managers and technicians across the country recognize the NABER Technician Certificate as the benchmark of professionalism.

To find out more about the NABER Technician Certification Program and supporting study material, contact NABER for a free brochure.



National Association of Business and Educational Radio
1501 Duke Street • Alexandria, VA 22314 • 800/759-0300

Circle (63) on Fast Fact Card

TESSCO™



YOUR TOTAL SOURCE...
TESSCO

800-638-7666

301-785-5300

151 LAKEFRONT

HUNT VALLEY, MD. 21038

YOUR TOTAL SOURCE...
TESSCO

800-638-7666

301-785-5300

151 LAKEFRONT

HUNT VALLEY, MD. 21038

Robert B. Barnhill, Jr. — President TESSCO

"At TESSCO, the Buck Stops with Me...and I Care"

To me, customer service isn't just some industry catch phrase. It's a real concern, and something I believe TESSCO does better than anyone else out there. You see, I understand that your success is our success. So doing what it takes to help make your business more profitable is what my business is all about — doing it as well as we do is good news for both of us.

We Give You A "Total Source" Product Line...

You don't want to waste time shopping a lot of different suppliers for the items you need. So we give you a "Total Source" product line of over 10,000 items from more than 60 of the industry's best-known manufacturers. From antennas to cable, tools to test equipment, it's all right here.

A Competitive Bottom Line...

Of course, our huge selection wouldn't mean much if you still had to shop other suppliers for price. So we do everything we can to make sure you get the items you need at the lowest bottom-line cost. If you can do better anywhere else, let us know... we'll try to make up the difference.

Delivery and Quality You Can Bank On...

Our toll-free 800 number makes it easy to place your order. And our nationwide network of distribution centers is the best way we know of to deliver your order when you need it, at the lowest possible cost to you. Best of all, your order is completely risk free. Take up to fifteen days to look it over. If you decide it's not what you need, send it back for a credit or prompt refund.

And We'll Treat Your Order With Care

When you buy from TESSCO, you're buying from one of the nation's largest suppliers of communications support products. But we didn't

get here by serving only our largest customers. We did it by going the extra mile to keep *all* of our customers happy, regardless of size. So whether you need a handful of battery taps or a complete antenna system, you can bet we'll treat your order like it's the most important thing in the world... because to you and your business, it is.

So go ahead, send in the attached information card or give us a call on our toll-free number. Either way, you'll be treating yourself and your business to the best service in the industry. How can I be so sure? Because at TESSCO, the buck stops with me...and I care.

Robert B. Barnhill, Jr.
President TESSCO



TESSCO™
Your Total Source®
800-638-7666

Chicago,
Illinois

Baltimore,
Maryland

Reno,
Nevada

Tampa,
Florida

Visit us at LM EXPO Booths #435 & 437.

GWB

Readers' choice

Of all the new products and services covered in the January 1988 issue of *MRT*, the ones reprinted here generated the most reader requests for additional information. If you missed them the first time, here is your opportunity to acquire more information on them: Just circle the corresponding Fast Fact number on the Fast Fact Card found in the back of this issue and mail the card to us.

Ion dissipation prevents lightning strikes



Ion dissipation is the basis of lightning prevention offered by the ALS-3000 from **Lightning Prevention Systems**. Copper radials buried in the ground collect positive charges. These charges travel to dissipating elements and are dissipated into the atmosphere. The immediate area is neutralized, eliminating the potential for a lightning strike. Each dissipating element contains 5,500 stainless-steel points.

Circle (200) on Fast Fact Card

Hand-held scanners cover nine or 11 bands

A pair of rugged hand-held scanner radios are the first portable scanners to carry the **Dynascan Cobra** label. Models SR-12 and SR-10 are multiband scanners with electronic digital tuning and user-programmable memories.

Model SR-12 offers 16 channels of programmable memory. Its 8-digit LCD can be backlit for night viewing.

The SR-12's nine-band coverage includes federal government (406MHz to 420MHz) and military (136MHz to 144MHz) land mobile; VHF high (148MHz to 174MHz) and VHF low (29.7MHz to 50MHz); UHF (450MHz to 470MHz) and UHF "T" (470MHz to 512MHz); aircraft (118MHz to 135.9MHz); and amateur radio broadcasts on the 2-meter (144MHz to 148MHz) and 70cm (420MHz to 450MHz) bands.

The 11-band coverage of model SR-10 includes those frequencies (except the aircraft band) and adds the 6-meter (50MHz to 54MHz) and

10-meter (29MHz to 29.7MHz) amateur bands plus instant access to National Weather Service broadcasts (162.4MHz to 162.55MHz).

Both units feature multifunction operational modes, including direct channel search and lockout. Model SR-12 adds priority scan, auto search, frequency limit and channel hold. Accidental programming is prevented with a keyboard lock on both models; also featured are a battery-low indicator and an internal memory backup.

The receivers have a sealed, water-resistant rubber keypad in a durable aluminum and plastic case. They can use standard AA or rechargeable nicad batteries as well as ac power. Six nickel-cadmium batteries, an ac adapter-charger, an earphone and a carrying case are standard accessories with model SR-12.

Circle (202) on Fast Fact Card

Mobile radios mount on console 'Poop-Deck'



Heavy-gauge (1/8-inch) aluminum forms the 17-inch wide Poop-Deck made by **S & S Manufacturing**. The deck mounts over the center floor hump and offers a mounting surface for mobile radio equipment. The entire console with radios can be assembled on a tech's workbench and then installed in the vehicle.

Circle (201) on Fast Fact Card

Unit enables relay or repeater operation

The TransPeater from **Transcrypt International** plugs into radios to provide relay or repeater operation. The unit can be plugged into two portables for an instant repeater. In the relay mode, the unit provides cross-channel or cross-band operation. It comes with DIN connectors that adapt to portable, mobile and base station units.

Circle (313) on Fast Fact Card

32-channel mobile features 75W or 40W output

The TK-822RH/822R UHF remote-mount mobile radio from **Kenwood** offers 32 semi-duplex channels and is available with 75W or 40W RF output. The synthesized unit covers a wide band of frequencies: 10MHz for the transmitter and 5MHz for the receiver. A scanning model is available.

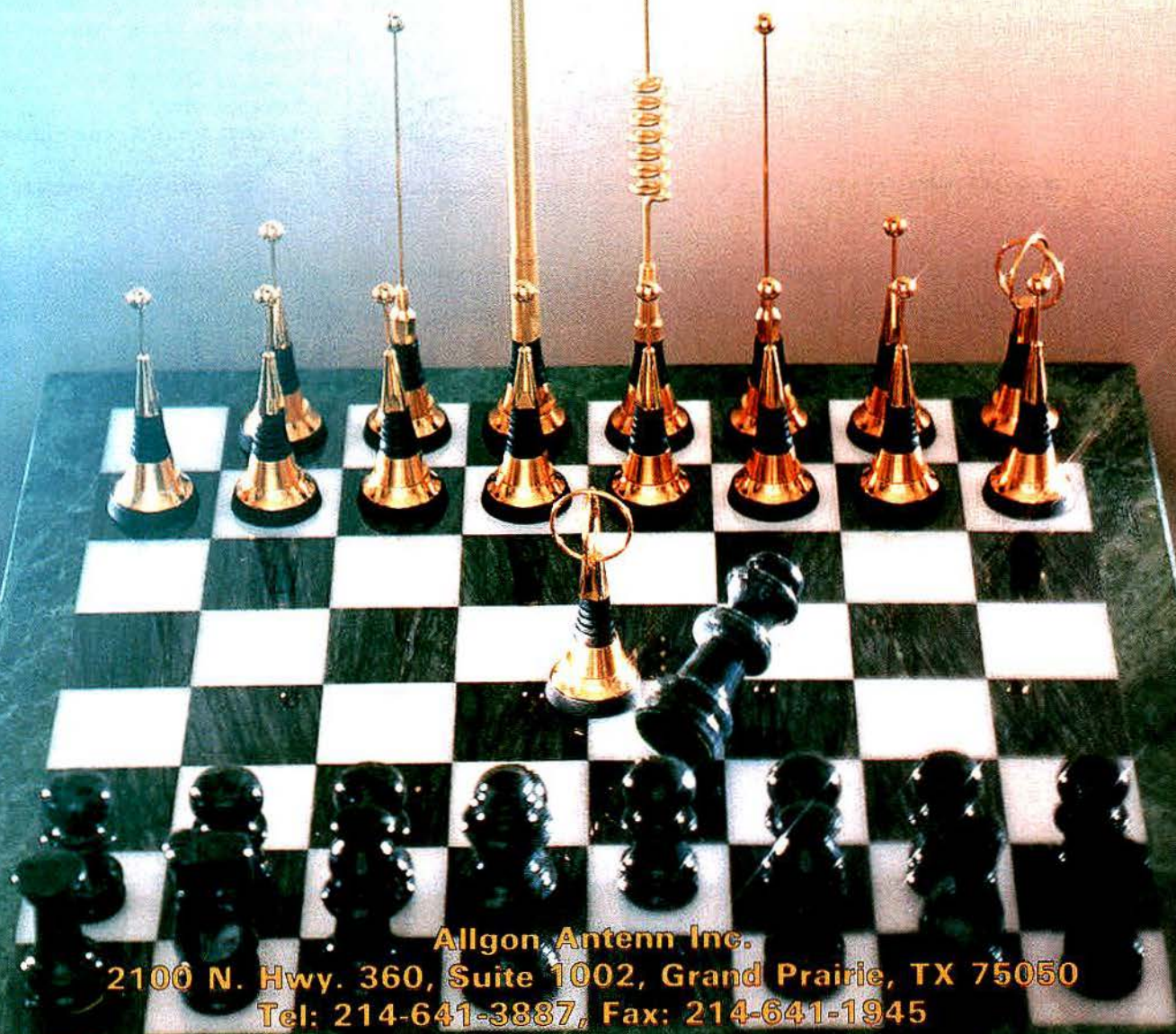
Circle (308) on Fast Fact Card

Cellular portable features 90 minutes of talk time

The Mobira 512 cellular portable phone from **Nokia-Mobira** is equipped with a self-help menu and backlit display and keypad. It has 832 channels, 90 minutes of talk time and 49-number memory. It comes with two rubber duck antennas, ac adapter and snap-in charger base, and a cigarette-lighter adapter.

Circle (302) on Fast Fact Card

Make the right move



Allgon Antenn Inc.

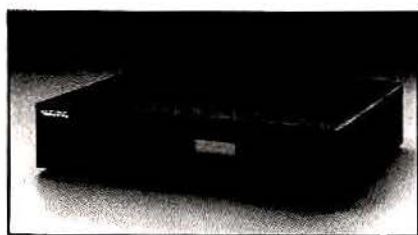
2100 N. Hwy. 360, Suite 1002, Grand Prairie, TX 75050

Tel: 214-641-3887, Fax: 214-641-1945

Circle (65) on Fast Fact Card

New products

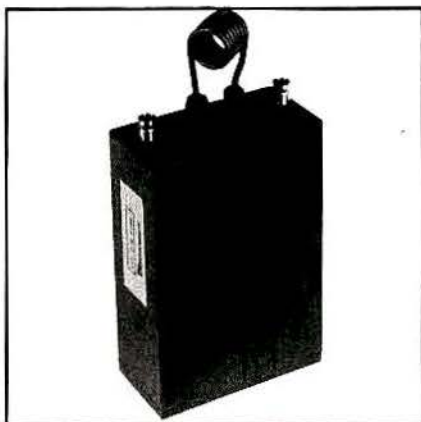
Communication controller provides RF data collection



The RC2250 RF system communication controller from **Norand Corporation** supports up to 32 portable RF terminals on an RF data collection system. The controller allows for remote data processing for mainframe computer users.

Circle (191) on Fast Fact Card

Notch filter eliminates paging signal interference



Model 6198 notch filter from **Micro-wave Filter Company** eliminates interference from paging signals at the IF frequency in RCC receivers. Notch depth at 72.2MHz is 30dB. Input connectors are BNC female, and output connectors are BNC male. Impedance is 50Ω.

Circle (181) on Fast Fact Card

Voice-powered communication is available for 6 headsets

Voice-powered communication systems from **David Clark Company** need no external power for short- or long-distance communication. The system features headsets with hands-free operation and hearing protection. The system is activated when the human voice travels to a transmitter, causing fluctuations in a magnetic circuit that creates a small amount of current (about 20mA). The current is sufficient to operate the receivers on up to six headsets.

Circle (190) on Fast Fact Card



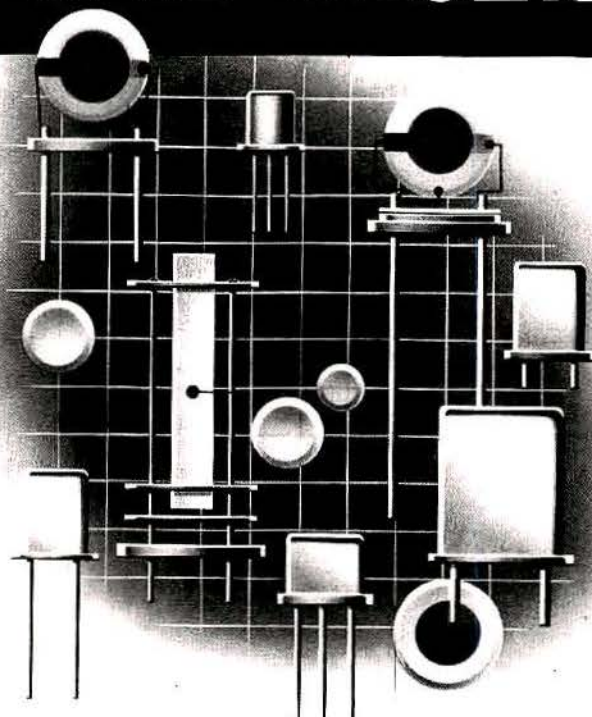
CUSTOM CRYSTALS

Crystals for many applications

For over 37 years, ICM has manufactured the finest in quartz crystals for every conceivable purpose.

A wide selection of holders are available to fit most any requirement. Our computer database contains crystal parameters for thousands of equipment types.

Need crystals for communications, telemetry, industrial, or scientific applications? Let ICM's sales department assist you to determine which type of crystal is best for you.



Circle (66) on Fast Fact Card

Can we solve your crystal problem?

For special purpose crystals, special holders, special sizes, call our crystal sales department. We will be pleased to provide recommended data.



International Crystal Manufacturing Co., Inc.

P.O. Box 26330, 701 W. Sheridan,
Oklahoma City, OK 73126-0330
Phone (405) 236-3741
Telex 747-147
Facsimile (405) 235-1904

Why Tinker Around When it Comes to Your Communications Testing.

**Cellular...
Trunking...
Tracking Generator...**

now available with the *New FM/AM-1200S*



The FM/AM-1200S is still the most feature intensive of all communications service monitors.

See for yourself. The FM/AM-1200S includes a 1 GHz spectrum analyzer, 1 MHz scope, 2 μ V receiver, duplex capability, 150 watt power meter, RS-232 interface and numerous programmable functions—all standard in one self-contained, compact and portable unit. With **three new options**, the 1200S can now test cellular mobiles; CLEARCHANNEL LTR® compatible mobiles/bases; and duplexers, combiners and isolators.

Think of the advantages of having all these features in one package. With the 1200S cellular option you no longer have to be concerned with what type of test interface the radio has. By connecting a coax between the transceiver and test set you are ready to go. When you need to verify a trunked radio, just connect the RF cable, enter the mobile and system information into the 1200S and execute. This now eliminates the need for "add-on" or accessory units to perform cellular and trunked systems testing.

How many times have you wished for a convenient, inexpensive way to observe the frequency response of a cavity or duplexer? The new 1200S tracking generator option will do just that. By connecting two cables, you can observe the frequency response directly on the 1200S' CRT, providing for instantaneous monitoring of filter characteristics.

Where else can you get all this capability in one communications test set? No where! Compare and you'll agree...the FM/AM-1200S **is** the logical choice.

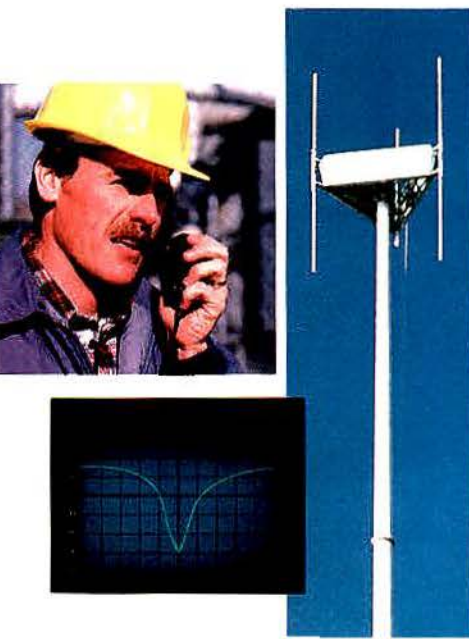
Don't tinker around! Buy IFR, the monitors that make the others seem like toys.



IFR SYSTEMS, INC. 10200 West York Street, Wichita, Kansas 67215-8935 U.S.A.,
Phone 316/522-4981, TWX 910-741-6952, FAX 316/524-2623
Circle (67) on Fast Fact Card



CLEARCHANNEL LTR® is a registered trademark of E F JOHNSON CO.



New products

Cable ties come in 1/4" and 3/8" widths

E.V.A. cable ties from **Band-It Idex** for cable bundling on towers and antennas are stainless-steel, coated with ethylene-vinyl alcohol copolymer. They are available in 1/4-inch and 3/8-inch widths and 6-inch to 36-inch lengths.

Circle (300) on Fast Fact Card



Hand-held's EEPROM needs no battery backup

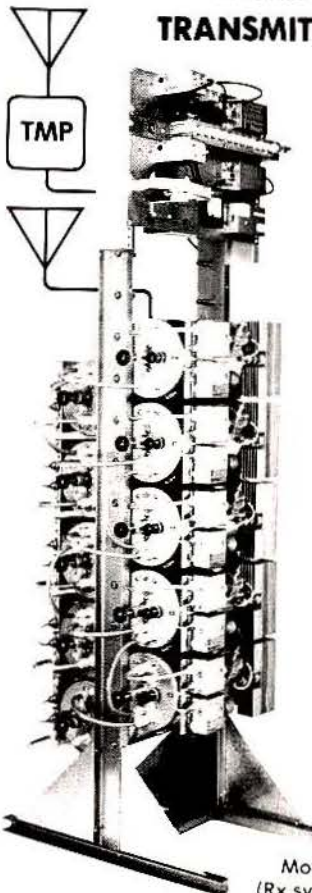
The SRX 1000 synthesized VHF hand-held from **Repeco** has 16-channel capability in the VHF band and a 5W/1W switchable RF output. A standard unit comes with high/low RF output, antenna, standard 500mAh battery and channel selectable CTCSS. Both programmable channel frequencies and CTCSS tones can be tailored to needs by use of the EEPROM programmer. The EEPROM allows new data input and does not require battery backup. The SRX 1000 provides a 10MHz frequency spread for added channel versatility.

Circle (210) on Fast Fact Card

EXPANDABLE T-PASS® 800 MHz TRUNKING

U.S. Pat. No. 4,249,147 Can. Pat. No. 1,133,598

TRANSMITTER MULTICOUPLERS



- Multicouple up to 20 Transmit channels on 1 antenna over the entire 806-960 MHz band with 250 KHz channel spacings.
- Shown is a 10 channel version with Receiver Multicoupler and Tower Mount Preamp controls mounted at the top of the T-Pass rack using optional 19" adaptor brackets. Without this option, space is available for incremental expansion from 1 to 15 channels.
- Transmitter channels with 125 Watt Isolator Loads also available.
- Monitor or retune Tx channels with -30 dB RF Sampler on each 60/125 Watt Isolator Load.
- Single antenna Transmit-Receiver models also available.

Write for Lit. #E211D7

Model No. 73-90-01-10-60-MA
(Rx system products not included)



For other Product Line information...
Duplexers, Cavity Filters, Repeater Amplifier Systems,
and RF System Products, write:

TX RX SYSTEMS, INC.

8625 Industrial Parkway, Angola, NY 14006
(716) 549-4700 / Telex: 755770
24 hr Fax No: (716) 549-4772

Circle (68) on Fast Fact Card

Entry-level trunking is targeted for public safety



The Sweet 16 entry-level trunking system by **General Electric** is suited for public service agencies that, despite limited budgets, want to use 800MHz trunked communications. The system includes fast access time, queuing, priority scan, individual call and emergency ID. Sweet 16 provides quick channel access, typically less than 1/3 second, and is capable of handling about twice as many calls per channel as conventional systems. Portables, mobiles and desk-top stations used on the system have field programmability, all-metal housing and alphanumeric displays that give the name and group of incoming calls for instant identification and faster response. The Sweet 16 system may be expandable to the 16 Plus advanced trunking system.

Circle (219) on Fast Fact Card

The Search is Over!



METS is the only company that offers the total AVL Vehicle Management System that employs all technologies for location and communications...**METS** is the total system integrator.

METS guarantee; If the **METS** custom system does not generate better customer service, reduced expenses or greater efficiency, then you owe us nothing!

- **Automatic Vehicle Location**

LORAN C • Dead Reckoning • GPS

- **Communications**

2-way UHF/VHF • Trunked Radios • Cellular • IMTS • Satellites

- **Computerized Mapping and Interactive Data Base**

Zooming Levels • 20,000 cities and towns

- **Customized Proprietary Software**

Address Matching • Routing • Scheduling • Exception Reporting • More

- **Information Logging**

Event Analysis • Trip Reports • Fuel Use Tax • Driver/Vehicle Performance • More

- **Monitoring Vehicle Functions**

Reduced Maintenance • Engine Temp. • Oil Pressure • Speed • RPM • Odometer • More

- **Custom Reports • 2-way Messaging • Security • And More**

METS is your one-stop-shop! We even have a program that offers no capital expense!

Make more money from your fleet!

If you want better customer service, reduced expenses, and greater efficiency, contact:

METS, Inc.

10585 N. Meridian
Suite 200
Indianapolis, IN 46290
(317) 573-2200

METS, Inc.

2301 W. Sample Road
Bldg. 2, Suite 1-A
Pompano Beach, FL 33073
(305) 979-5404



Licensee to GE
digitally trunked radio system.

Circle (69) on Fast Fact Card

New products

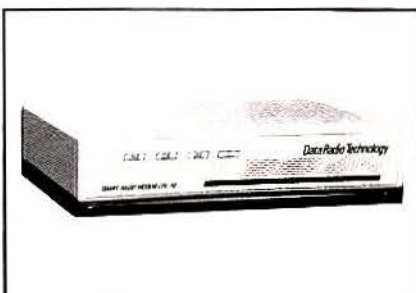
SMR interface enables 7-digit dialing, up to 10 sites

Model SS-650 SMR Interface Plus from **Hark Electronic Systems** allows an SMR operator with several sites to provide seven-digit dialing for as many as 10 sites. Via the dial-up lines associated with the existing interconnect, the unit eliminates the need to run DID trunks to the SMR site. The interface

features call forwarding controlled by the mobile user and a call accounting function that tracks calls and minutes per subscriber. The unit can be used on existing DID trunks to steer spare numbers to the SMR without interrupting the primary DID equipment.

Circle (203) on Fast Fact Card

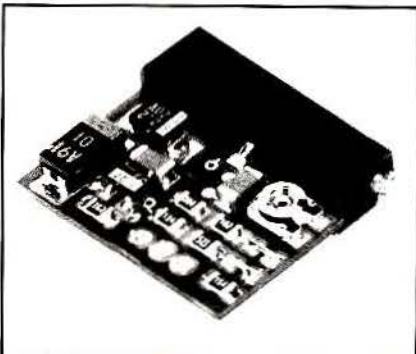
Packet radio modem offers error correction, networking



The CPU-50 smart packet radio modem from **Data Radio Technology** provides full error correction, automatic digital repeater operations networking, unidirectional broadcast operation, RS-232 interface, and full- and half-duplex operation. The RS-232 serial port accepts speeds from 1,200 baud to 9,600 baud. User selectable items include unit address, transmitter settling time, idle link timeout, packet resend timing and packet length.

Circle (315) on Fast Fact Card

Universal mini CTCSS encoder mounts easily in radios



The super-miniaturized ST-140 CTCSS encoder from **Selectone** is compatible with all standard CTCSS systems and packs field-tunability to any frequency from 67.0Hz to 250.3Hz into a package the size of a nickel. It mounts easily in any mobile or portable two-way radio. The unit can be used to key radio repeaters or to selectively call any one of several base stations, mobile units or both. It operates on 5.5Vdc to 16Vdc at less than 2mA.

Circle (238) on Fast Fact Card

PL* KILLER

Party lines are dead!

With radio channels in short supply, it helps to put two or more plumbers, contractors, or other competing businesses on the same channel.

Pvt SQUELCH™ takes your standard radio party line and inverts the audio. People quack like ducks. Those assigned the right CTCSS tone hear clear, reinverted speech.

VOIL'A! No more Party Line

And the whole thing is a pin-for-pin fit for the CTCSS option in a Midland LMR. To order, call toll-free: 1-800-638-5577

MX365 programmable CTCSS Encoder/Decoder

MX P1080 Pvt SQUELCH board for Midland Syn-Tech radio

MX004 VOICE BAND INVERTER

MX•COM, INC.

4800 Bethania Station Rd., Winston-Salem, NC 27105-1201

*PL is a registered trademark of Motorola.

Circle (70) on Fast Fact Card



Maxon... A Growing Family of Professional Communications Equipment

Maxon builds the smallest high power portable radios on the market, and yes, we are a low price leader — but it's more important that you know we are growing because our products last. Maxon products are built with glass-epoxy FR-4 circuit boards, solid state switching and the highest quality antennas and controls — no shortcuts! Our 5-watt "HD" portables meet several criteria of MIL-SPEC 810D, are available as INTRINSICALLY SAFE for

many levels of hazardous conditions, and feature high impact, die-cast aluminum frames, plus multi-option capability. Our high power mobiles have rugged steel cases, are only 1 3/4" high, and carry an exceptionally low price. And, finally, our HSC-format pager is the only pager offering DATA-PLUS-VOICE capability and compatibility with most transmitting systems. That's Maxon — small, low cost, but built to last!

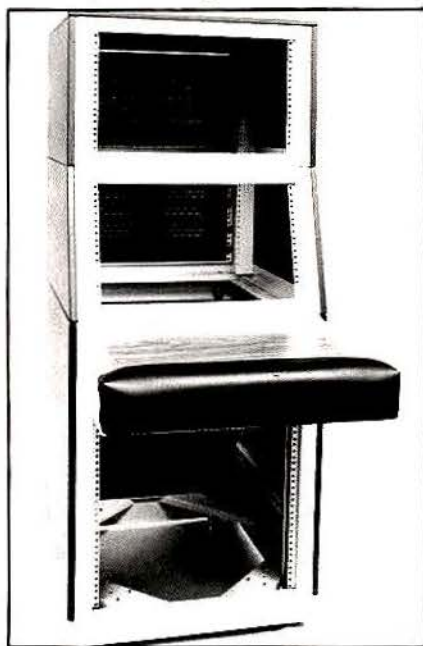
maxon **ELECTRONICS**

10828 NW AirWorld Drive, Dept. 100
Kansas City, MO 64153 — USA
816/891-6320; TWX 9107717080 MAXON/PAL KSC

Canadian D.O.C. approved.
© 1988 — Maxon Electronics
Circle (71) on Fast Fact Card

New products

Modular consoles suit CCTV, security needs



Modular consoles, racks and accessories to protect CCTV surveillance and security control equipment are available from **Atlas/Soundolier**. The modular enclosures accommodate camera control, video monitor and command centers.

Circle (189) on Fast Fact Card

Phase shifter operates from 1GHz to 18GHz

Model MS1018 phase shifter from **KDI Electronics** operates from 1GHz to 18GHz with 20° continuously adjustable phase shift at 1GHz. The adjustment range increases linearly as the frequency increases. VSWR is 1.7:1, and insertion loss is 1.5dB.

Circle (292) on Fast Fact Card

Desktop unit provides fixed station remote control

The M81 fixed station remote controller from **Philips RCS** provides remote control of a single fixed radio station. The desktop unit has volume and tone controls, audible alert on receipt of call and intercom with other units in the series connected. Options include a desk mic, telephone handset and headset with boom mic.

Circle (195) on Fast Fact Card

Data communications unit operates without modems

The DataMover BDM-1000 from **Bydatel** combines cellular and microchip processing to provide digital data communications. It operates in a network with a Bydatel DataMover repeater and requires no modems or lines. The device operates in the 70MHz to 960MHz range. Features include synchronous and asynchronous modes, automated protocol sensing, polling emulation, data compression, proprietary protocol, CRC and error-detection techniques and 24-hour memory retention.

Circle (294) on Fast Fact Card

Service monitor has built-in frequency counter



Model 2100 communications service monitor from **CT Systems** offers high-resolution dual-digital displays, FM deviation markers, memory storage and recall, built-in frequency counter and off-the-air monitoring.

Circle (297) on Fast Fact Card

Compact synthesized mobile offers one to four channels

The mobile compact synthesized (MCS) transceiver from **General Electric** offers as many as four channels across a wide band of frequencies. PC programmability allows frequencies and CTCSS tones to be programmed from the user's own personal computer. The radio complies with MIL SPEC 810C and D, and it has 5W audio output. The user can select either digitally controlled or tone-controlled squelch or both on each channel.

Circle (214) on Fast Fact Card

COM-3 SERVICE MONITOR

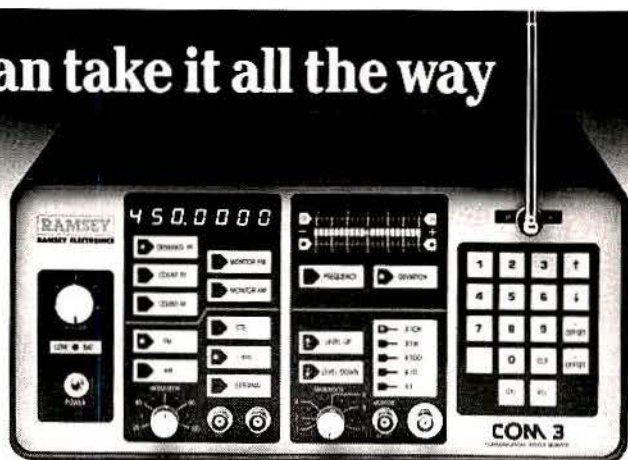
When it comes to performance, flexibility and value, COM-3 will outdistance any compact service monitor. In fact, no other compact monitor can even come close. Engineered as a true portable unit, COM-3 is a ton of advanced microprocessor technology and superb testing capability crammed into a compact and rugged

At \$2495, you can take it all the way to China.

13 lb power house.

What's more, COM-3 will easily fit under the seat of any airliner. And, with the 220 VAC option, you could handle service calls anywhere in the world... even China.

COM-3. The new service monitor that works harder for less.



RAMSEY ELECTRONICS, INC.

2575 BAIRD ROAD, PENFIELD, NY 14526

TEL: (716) 586-3950

TELEX: 466735 RAMSEY CI FAX: (716) 586-4754

Circle (72) on Fast Fact Card

RAMSEY

Quality crafted in the USA





AT THE CENTER OF IT ALL "THE SWITCH"

It's the complete R.C.C. central office, and the most flexible.

- It's compatible with IMTS, IPTS, DTMF, G.E. MARC V, and SMART[™] signaling.
- It includes voice, tone and readout paging.
- Its various models are capable of going from one to thirty channels.
- It's ideal for telephone company, and RCC/SMR combinations.
- It encodes MOTOROLA GSC and NEC POCSAG Alpha/Numeric pagers.
- It networks with other switches for statewide, or nationwide systems.
- It has advanced features such as call forwarding, least cost routing, and voice mail box interfacing.

Pressure won't affect Freeman's performance. When other suppliers can't act, WE WILL. Our competency and ability to install quickly won us a \$1,000,000+ contract.

Our remote diagnostics repair ability is unparalleled in the industry. Our field engineering and repair staff is experienced in all aspects of system servicing, whether it's radio, switch, or telephone. They understand the consequences of being off the air. If you have a problem, WE WILL be there to solve it.

Freeman Engineering's capabilities are just as flexible as you need them to be. It's the answer to your paging or mobile system needs; your requirements define the system. WE WILL turn your ideas into dollars.

Freeman
Engineering Associates, Inc.

3100 Fifth Street, Metairie, Louisiana 70002
(504) 831-7785

Circle (73) on Fast Fact Card

New products

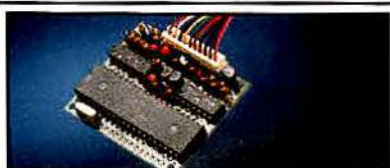
The following Product Previews from the June issue are reprinted because their respective photos were in-

advertently flopped in the camera process.

Bench-mount attenuators span dc to 2GHz range

JFW Industries' 50Ω bench-mount rotary attenuators are available with 0dB to 80dB in 1dB steps and with 0dB to 110dB in 1dB steps. Frequency ranges include dc to 2GHz.

Circle (236) on Fast Fact Card

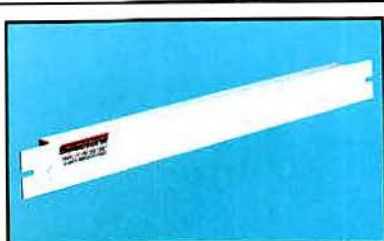


Encoder-Decoder for Fleet Applications

Sigtone's S1500MK2 five-tone selective calling encoder-decoder improves fleet efficiency with the following features:

- Reliable high-speed signaling (0.1 second)
 - Fully automatic handshake
 - Individual, group and all call
 - Quiet base and mobile operation
 - Audible and visual call alert
 - Small size and simple installation
- Call 800-LA5-TONE.

Circle (354) on Fast Fact Card



New Shared Repeater Panel from Selectone

Selectone Corporation's new digitally programmable shared repeater panel, the ST-180 Digitone system, provides eight tone channels (maximum) at only \$229 (including one channel) plus \$19.95 each for additional channels. The compact ST-180 features DIP switch programmability of any of the 37 RS-220A CTCSS frequencies, plus 97.4Hz.

Circle (355) on Fast Fact Card

Repeater programming software allows customizing

The EZ-Speak 3 revised version of repeater programming software from Electron Processing allows repeater operators to use the verbal capabilities of the Advanced Computer Controls' model RC-850 and RC-85 microprocessor-based FM repeater controllers easily. The program sidesteps error-prone procedures. The version allows the user to customize the vocabulary and system configuration and allows the user to upgrade the software to suit specific requirements.

Circle (295) on Fast Fact Card

Measure Up With Coaxial Dynamics Model 83500 Digital Wattmeter

The "Generation Gap" is filled with the "new" EXPEDITOR, the microprocessor based R.F. AnaDigit System. The EXPEDITOR power computer...you make the demands, it fills the requirements.

- Programmable forward AND reflected power ranges.
- Can be used with the elements you now have.
- Compatible with all Coaxial Dynamics line sizes and power ranges.
- 18 scales from 100 mW to 50 kW.

Contact us for your nearest authorized Coaxial Dynamics representative or distributor in our world-wide sales network.



COAXIAL DYNAMICS, INC.

15210 Industrial Parkway
Cleveland, Ohio 44135
216-267-2233 1-800-COAXIAL
Telex: 98-0630

Service and Dependability...A Part of Every Product



Circle (74) on Fast Fact Card

You can
get 'em
cheaper
but not
better



The Reach Pager...the industry's BEST!

- ★ LIGHT IN WEIGHT, BUT HEAVY IN PERFORMANCE
- ★ LOUD, CLEAR VOICE MESSAGE
- ★ "HANDS FREE" OPERATION

No battery charging

(24-hour-a-day service for several months, on one throwaway battery)

THE BEST TONE & VOICE PAGER

★ MADE IN U.S.A. ★

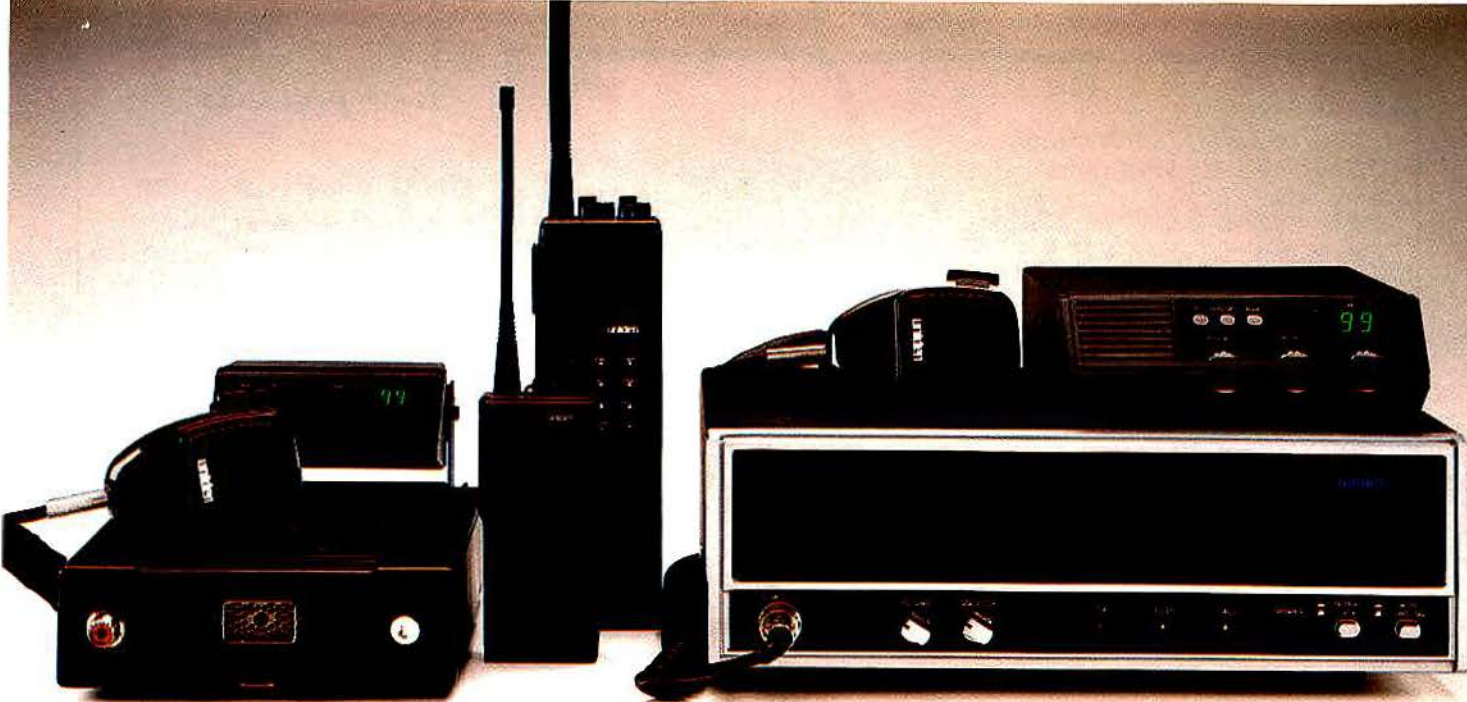


REACH ELECTRONICS INCORPORATED

P.O. BOX 308, LEXINGTON, NE 68850-0308
TWX 910 960 4741 (308) 324-6661
FAX 308-324 4985 (800) 445-0007

Visit us at Expo East, Booths 114-118.

Circle (75) on Fast Fact Card



2-Way. A Better Way.

One Source With All The Resources.

Now when you want to buy 2-way, you only have to look one way. Look to Uniden.

Because Uniden offers a complete and versatile line of components. Everything from hand-helds to repeaters, crystal to synthesized, low band to 900 MHz, standard or custom. All fully integrated by band.

Every Uniden unit is engineered to deliver top-of-the-line performance, too.

Performance that comes from over twenty years of experience. Performance that businesses and emergency personnel depend on throughout the world. And performance that's backed by

one of the strongest dealer networks in the industry.

Another reason to look to Uniden is because we look ahead.

We're already expanding 2-way systems far beyond expectations with voice data transmissions and multi-region networking. But this is only the beginning, and with our expertise, there's no end in sight.

Choose a better way in 2-way, Uniden Commercial Communications. All the equipment you need today. All the technology you'll need tomorrow.

The Choice of Professional
Golfer Jack Nicklaus.

© 1988, Uniden Corporation of America



uniden®

A New Generation of Communications



Circle (76) on Fast Fact Card

NEW

Bird Broad Band Directional
THRULINE® RF Wattmeter

Six Reasons Why MODEL 4304A Is Your Outstanding Value In Two-Way RF Communications Wattmeters

1. Covers all powers...5 to 500 Watts in 5 ranges
2. One broad band element...covers 25-1000 MHz
3. Full scale use...no "off limit" areas
4. Accurate...element calibrated to instrument
5. Simple to operate...no element changes required
6. Die cast aluminum housing...withstands rugged service

Call for more details on how THRULINE® Model 4304A RF Wattmeter can simplify testing of two-way RF equipment.

BIRD

Electronic Corporation

30303 Aurora Rd., Cleveland (Solon), Ohio 44139 — 2794
216-248-1200 TLX: 706898 Bird Elec UD FAX: 216-248-5426
WESTERN REGION OFFICE:
Bird Electronic Corp.
621 Ojai Ave., Suite F, P.O. Box 28, Ojai, CA 93023 805-646-7255

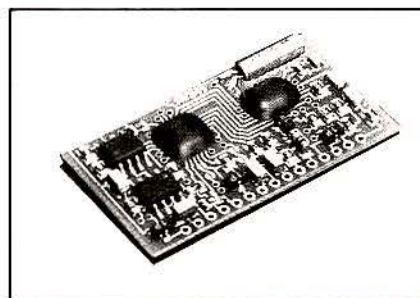


Circle (77) on Fast Fact Card

New products

DTMF decoder features deadbeat disable, enable

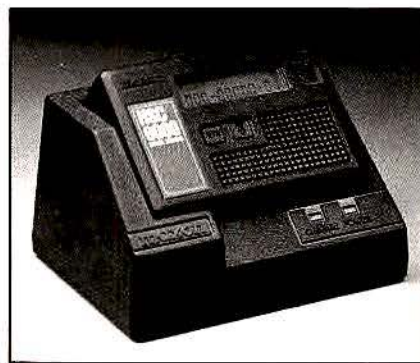
The AW-341 DTMF decoder from Airwave has three call addresses: individual, group and all-call, all of which can be reset remotely. Programming is completed using DTMF tones, instead of DIP switches or jumper wires. Codes are one to seven digits long. Any of the 16 DTMF tones may be used. A beeping alert tone also is provided. Deadbeat disable and enable functions may be used for turning off service to a non-



paying customer or for remote control. The decoder transponds on the individual call and on deadbeat disable and enable.

Circle (204) on Fast Fact Card

HSC-format pager delivers data and voice



The HSC-6000 series display and voice pager from Maxon Electronics operates on the HSC analog format and does not require special digital transmitters. The pager features a large numeric LCD display, 72-character memory and three-digit prefix for wide area roam. It can be powered by alkaline, mercury, lithium or rechargeable nickel-cadmium batteries. The pager's CAP codes can be changed by the carrier's office personnel, requiring no PROM devices.

Circle (232) on Fast Fact Card

MOVING?

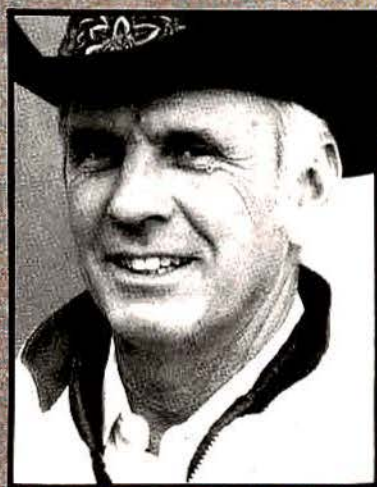
TAKE US WITH YOU.

Just peel off your subscription mailing label and attach it to the address change card inside this issue. Please allow 6-8 weeks to process your address change.

There is supposed to be an Indy Car race here next weekend...



But only if Wally and Regency say so!



"Radio people are the first and last people on the scene of each CART racing event," says Wally Dallenbach, CART official and former Indy Car race driver. "Our entire operation — safety, rescue, fire, race control, the pace car, even the TV crews — all depend on clear, two-way communications. Without it, we just won't run the race!"

CART officials don't take chances. They count on their radios for smooth administration and life saving communication at every race. Whether it's a road course or oval, from the Meadowlands to Long Beach, Regency radios meet their exacting demands. That's why Regency Land Mobile Inc., is the official supplier of two-way radio equipment for every CART Indy Car race event.

Call now to find out more about Regency's complete Land Mobile Radio systems. Take control of your race with Regency!

REGENCY LAND MOBILE, INC.
7707 RECORD STREET
INDIANAPOLIS, IN 46226
1-800-428-5000

Visit us at Expo East, Booth #111.

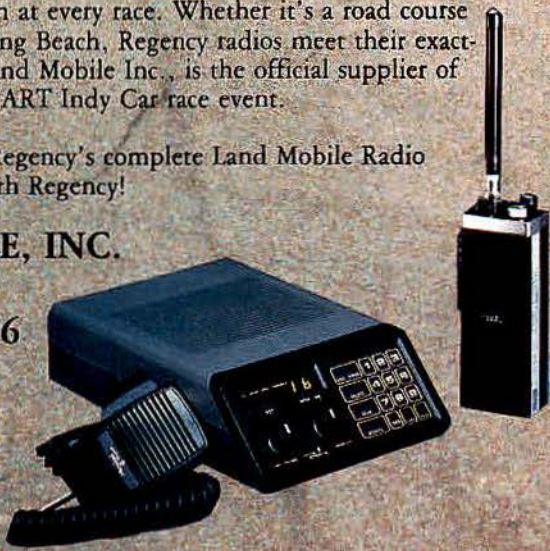
"We've been using Regency Radios in our CART racing series for 8 years. We know we can depend on Regency performance. They never let us down."

— Wally Dallenbach, Director of Competition/Chief Steward at CART for the past 8 years.

— Indy Car driver for 14 years.

CART
CHAMPIONSHIP AUTO RACING TEAM, INC.

Circle (79) on Fast Fact Card



• Photo compliments of Michigan International Speedway.

New products

32-bit microprocessor boards upgrade paging, TAS lines

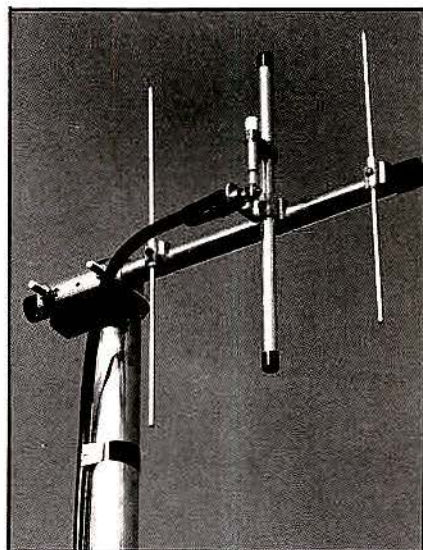
With the addition of 32-bit microprocessor boards, **Spectrum Communications & Electronics** offers upgraded lines of paging, voice messaging and telephone answering service (TAS) terminals.

Circle (318) on Fast Fact Card

6dBd UHF yagi antenna suits control stations

The Cushcraft/Signals P457-3 three-element 6dBd UHF yagi antenna is suited for applications requiring less gain and more economy. Applications include for control stations with short paths and on links where overshoot can interfere with other users.

Circle (163) on Fast Fact Card



QUALITY USED RADIOS GE MASTR PROS

MT75TCU88

450-470MHz,
100Watt, 2 Channel,
Channel Guard.

\$210⁰⁰



Bench tested, guaranteed excellent
operating condition. Complete with accessories

ERIE ELECTRONICS, INC.

P.O. Box 11—Hiler Branch, Buffalo, NY 14223
(716) 833-8400

Ask for Bill Ryan

Circle (80) on Fast Fact Card

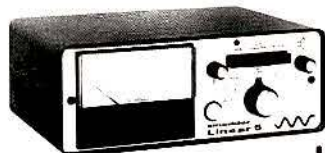
Dual-band hand-held allows selectable power ranges



Yaesu's dual-band hand-held radio covers 20MHz bandwidths at VHF and UHF. It has multiple tone options, a time-out timer and scanning. Selectable power ranges are available.

Circle (304) on Fast Fact Card

SL-105 SINADDER™ NOW—WITH AUDIO DISTORTION SCALE



SL-105 \$367
CML-1 with C-message
filter for Cellular \$479

True RMS SINAD & 8 range RMS Voltmeter

HELPER INSTRUMENTS COMPANY

407/777-1440
800/327-9308
FAX: 407/777-1447
TELEX 362837 (HELPER UD)
P.O. BOX 3628
INDIALANTIC, FLORIDA 32903 USA

Circle (81) on Fast Fact Card

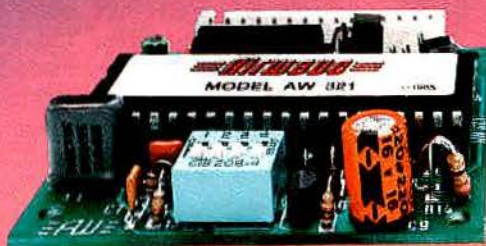
Disguise roof-mount antenna spans 70MHz range

The Cellmaster roof-mount disguise antenna from **Les Wallen Manufacturing** covers a 70MHz range from 890MHz to 960MHz. The antenna is 3½ inches high and suits two-way and cellular applications.

Circle (305) on Fast Fact Card

AIRWAVE

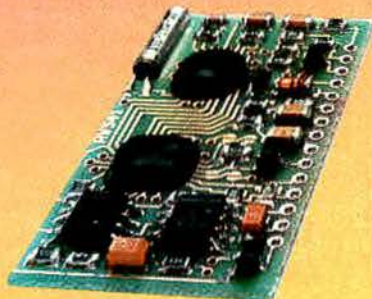
Selectone



UNIVERSAL DECODER



ENCODER/DECODER



SUPER-MINIATURE
DECODER



MINIATURE DECODER



DECODER MODULE



NEW HORIZONS IN DTMF TECHNOLOGY

On the morning of May 20, 1988, Selectone Corporation acquired AIRWAVE, INC., creator of the industry's most innovative DTMF technology. The result: The dawn of a new era in DTMF signalling.

With the addition of AIRWAVE'S full-featured, micro-processor based DTMF designs, Selectone, already a leader in tone signalling, can now offer the industry's broadest line of DTMF decoders, encoder/decoders, and ANI systems.

Check these exciting features common to all SELECTONE/AIRWAVE decoders:

- Super-miniature size/low current drain
- Individual call with remote reset
- Group/all call with remote reset
- Transpond acknowledgement tone
- Alert tone output
- Remote "Deadbeat" disable and enable
- One to seven digit address code
- EEPROM programming with any DTMF encoder

For full facts on the entire new Selectone/Airwave product line, call us toll free at (800) 227-0376

Selectone

Selectone Corporation • 23278 Bernhardt St. • Hayward, CA 94545
Phone: (415) 887-1950 • TWX: 910-383-0709 • FAX: (415) 887-4011
In Canada: Eastcom Industries, Ltd. • 430 Signal Drive
Weston, Ontario M9L 2T6 • (416) 743-7801

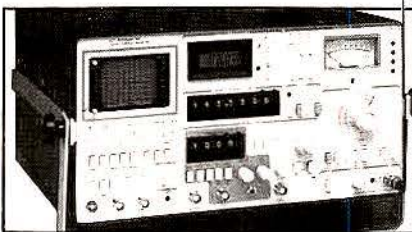
Circle (82) on Fast Fact Card

New products

Tester is loaded with spectrum analyzer

The CT Systems model 3000S communications service monitor combines model 3000B tester with a spectrum analyzer. The unit includes CTCSS tone display, oscilloscope, RF sweep, FM markers, zero beat and audio synthesizer with burst. Model 3000S is made of rugged construction and is portable.

Circle (227) on Fast Fact Card



TNC connectors can be installed in the field

Crimp-on and twist-on TNC connectors are available from **Cambridge Products**. Designated "Fastfit," the connectors have a forked and preassembled center contact located between two insulators. The contact captures the solid center conductor of a coaxial cable in a secure position. Cables with solid center conductors are thus terminated with a labor savings of as much as 38%. Components include jacks, plugs, right-angle plugs, bulkhead connectors, adapters and connectors for PVC and Teflon-jacketed cable.

Circle (256) on Fast Fact Card

STATI-CAT

Let us design a system for your facility using our building block system: Stati-Cat (SC-1), Crow's Nest (CN-1) and Stati-Kitty (SC-3). No charge for design.

Eliminate Costly Lightning Damage!



Through the use of sharp, stainless steel points, the **Stati-Cat** System provides a continuous low-resistance discharge path for the static electric charge found on all tall structures. Designed for long life, dissipation points are 1/8" type 304 stainless rod machine ground to needle sharpness. They won't bend from ice and severe weather.

Write for a free brochure.

Also available from Cortana:
Folded Unipole Antenna Kits
Ground Radial Wire Detectors

Cortana
Corporation

4001 LaPlata Highway
Farmington, NM 87401
(505) 325-5336

Mastercard/Visa

Circle (83) on Fast Fact Card

Remote adapter connects radio to DTMF telephone

The TransTel adapter from **Transcrypt International** connects a two-way radio to a DTMF telephone for remote control.

Circle (312) on Fast Fact Card

Two-way FM radios have reprogrammable memory



The Radius M206 and M214 two-way FM transceivers from **Motorola** offer reprogrammable internal memory. M206 provides up to six-channel capability in 25W low power or 35W to 40W high-power models in VHF and UHF and 15W for conventional 800MHz.

M214 is available with the same power output and 14-channel operation. It also offers channel scan monitoring, with or without priority. A scan list can be entered from the front panel and retained in memory.

Both radios provide users with CTCSS and digitally coded squelch. Both models are available with an LED numeric display to indicate channel or scan status.

Circle (208) on Fast Fact Card



NEW!



CELLULAR PHONE BATTERY CHARGER

Recharge your cellular phone battery with the new N.C.E. FLOAT VOLTAGE BATTERY CHARGER. Units available for charging 2 or 4 batteries at one time.

Order direct from: N.C.E. Inc./Power Group International, Dept. 227, 2200 W. 66th Street, Richfield, MN 55423 or call 612-890-1360 for more information.

Circle (84) on Fast Fact Card

Sales aid.

Time is money, money is time. And Standard two-way radios can save you both.

With a reliable Standard mobile radio in your car, service truck or delivery van, you're never out of touch with home base. So you'll never have to drive back to the office to learn about the customer who was only two blocks away from your last call.

And with Standard radios and accessories, you can build a system that's perfect for your operation. Start with features like programmable scanning of selected frequencies, then add a telephone interconnect or "trunking" technology to find open channels and speed your call.

If you spend time away from your vehicle, choose from a full line of lightweight, powerful Standard handheld radios. Combine one with a mobile extender, and you can transmit and receive with much greater range through your vehicle's mobile radio.

Back at the base, push-button controls make the Standard control console easy to use; high-tech circuitry makes it reliable. What's more, the console gives you useful features like a private channel option which allows two different groups of users to hear only those calls intended for them.

Standard mobile radios are the smart alternative to high-priced cellular sys-

tems, especially for service and delivery operations where constant, reliable communications are a business necessity.

To get the full story on how a Standard two-way system can help your business, contact Standard or your local Standard dealer for a free, no-obligation consultation.

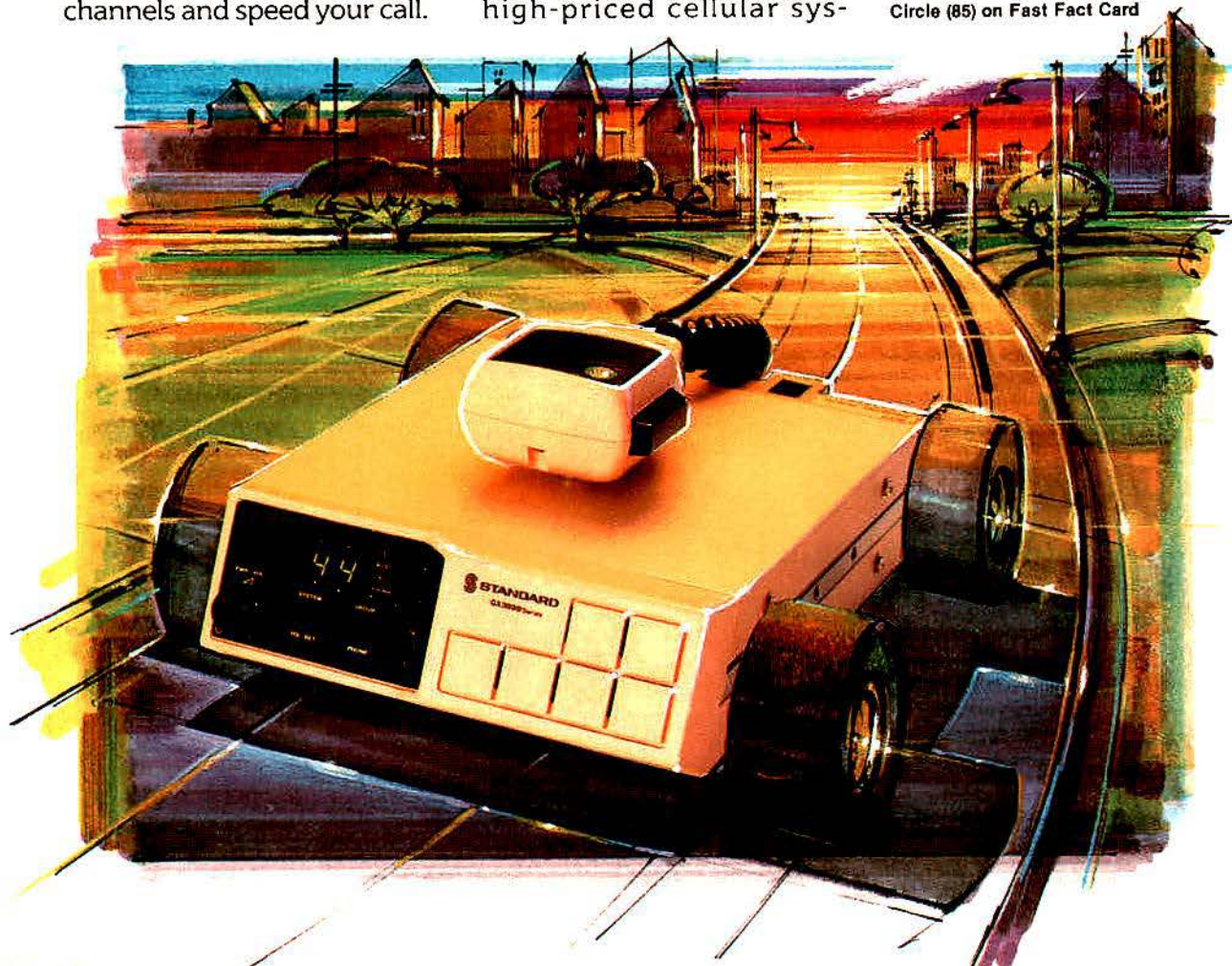
The business radio people.

 **Standard
Communications**

P.O. Box 92151
Los Angeles, CA 90009-2151
Telephone: (213) 532-5300

Represented in Canada by:
Cardon Communications, Hamilton, Ontario
416/527-1040

Circle (85) on Fast Fact Card



New products

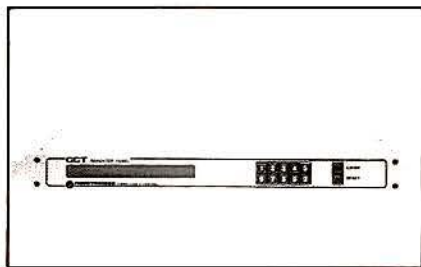
Communications console mounts on desk or table

The Versi-Com 2000 communications console from **Repeco** may be mounted on an office desk or table and is divided into three sections called "ports." In the center port, the command control panel provides the operator with a mic, VU meter and two speakers. Plug-in channel modules are in the left port, and five types of modules may be installed in any of the five slots to meet the

operator's needs: tone, dc, monitor, E&M, switch and encoder. On the command control panel, 11 controls allow the operator to perform such functions as adjusting speaker levels, controlling channel transmissions and establishing communications between the console and a base station or with parallel consoles.

Circle (213) on Fast Fact Card

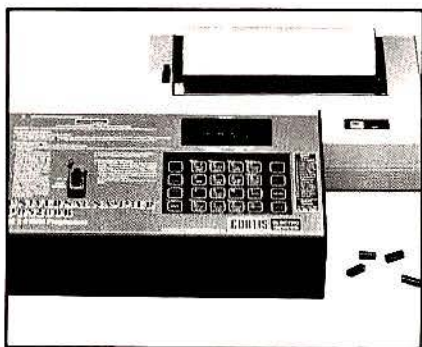
Repeater tone panels can be modified on-site



Ferritronics CCT series repeater tone panels offer CTCSS-compatible trunking of two to seven channels in any frequency band. Basic CCT series equipment can be modified on-site to convert from local control to remote control; to add telephone interconnection; or to connect with a computer for automatic billing. All models come equipped to enable or disable signaling tones either locally or remotely and to provide information for printing hard copies of hits and airtime usage records.

Circle (207) on Fast Fact Card

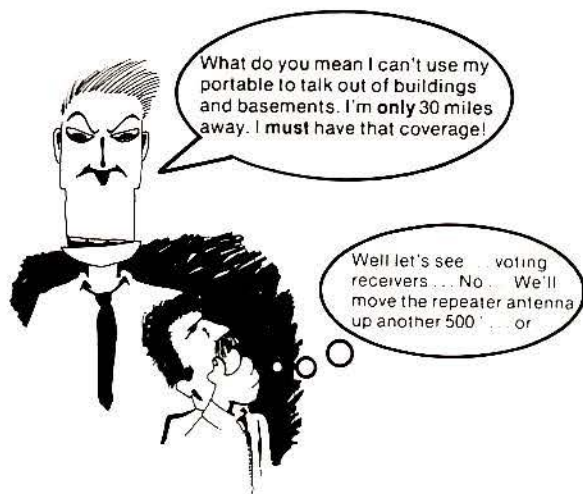
NAM programmer works with non-standard radios



With optional firmware and adapters, the PR5200B universal Nammer from **Curtis Electro Devices** can program cellular radiotelephones that do not employ the industry standard 32x8 NAM. Options are available for Motorola, Radio Shack (Tandy), Mobira, Panasonic and Philips radio models. Also available are IBM PC programs for the GE MARC V series and E. F. Johnson LTR8700 models.

Circle (183) on Fast Fact Card

COMMUNICATIONS SOLUTION #2



It's easier and less expensive than that, Mr. Dealer.

The **Xtenda-Comm** vehicular repeater will give your customer the same coverage with his portable that he has with his mobile.

Let us give you the details . . . 618-939-3870

SWEET

ELECTRONICS CORP.
WATERLOO, IL 62298

Circle (86) on Fast Fact Card

tdi PREMIUM BATTERIES



At last! A battery manufacturer capable of supplying **PREMIUM** replacement batteries for hand held radios.

With more than 10 years experience in supplying customized battery packs to the electronic industry and pager batteries to the RCC industry, TDI brings you the quality you've come to expect from the Original Equipment Manufacturer.

TDI Communication Batteries are competitively priced and available, from stock, for your immediate delivery.

tdi

2320 WISCONSIN AVE., DOWNERS GROVE, IL 60515
(800) 323-7307 or (312) 971-3460 (In Illinois)

Circle (87) on Fast Fact Card

CAD unit can be added to portables, mobiles

The CARD (computer-aided radio dispatch) module from **Transcrypt International** tracks radios and transmissions with unit ID, status and time of day. Emergencies take priority status. The CARD system fits portables, mobiles and inside control heads. It is used with the company's SC-460 module and requires an IBM PC or equivalent.

Circle (311) on Fast Fact Card

Synthesized portables feature 3 scanning systems

The IC-U18 and IC-H18 synthesized portables from **ICOM** have 5W RF output and three scanning systems that scan 50 channels per second. Both have 16 programmable channels and exceed military standards 810C and 810D. The UHF IC-U18 operates in the 450MHz to 470MHz range; the VHF IC-H18 operates in the 136MHz to 174MHz range.

Circle (309) on Fast Fact Card

10-channel mobiles have built-in scan



The RM mobile radio line from **Regency Electronics** comes in three versions: RML, with 60W power in the 30MHz to 50MHz range; RMV, with 60W power in the 148MHz to 174MHz range; and the RMU, with 45W power in the 450MHz to 482MHz range. The radio has 10 channels, built-in scan, scan delay, time-out timer and 12-hour clock.

Circle (182) on Fast Fact Card

Repeater controllers support digitally coded radios

Model 48 repeater manager and model 38 repeater panel from **Zetron** can support digitally coded radios such as the Motorola DPL. Model 48 repeater manager supports 22 digital codes in addition to 38 CTCSS tones; it is a combination repeater panel and multi-user telephone interconnect. Model 38 repeater panel also supports 22 digital codes and 38 CTCSS tones.

Circle (286) on Fast Fact Card

Trunking portable offers 10 systems with 20 channels

The FPS 910/920 TS synthesized trunking hand-held from **Uniden** features 10 systems with up to 20 channels in each. The radio covers a 600-channel band without retuning. The portable allows 10 group IDs per system for fleet and subfleet operations. FCC type acceptance is pending.

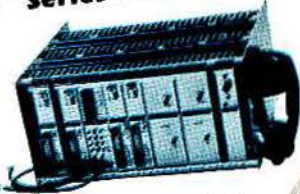
Circle (283) on Fast Fact Card

THREE GOOD REASONS FOR SELECTING ISC CARDION PRODUCTS

As a Leading Manufacturer of FM Analog Point to Point Radios and FM - FDM Multiplex Since 1950 We Can Address Your System Requirement With In-House Capabilities

- Computerized Path Design
- FCC Licensing Assistance
- Emergency Restoration Units

COMM-PAK™ Series 8000 Radio



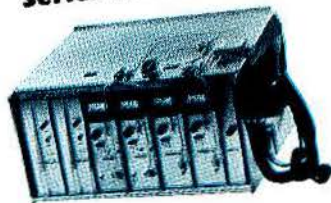
- Compact Modular Design
- 960MHz and 2GHz Operation
- Field Proven Reliability
- Up to 36 Channels

SKYTRAX™ 9500 DTL Multiplex



- Synthesized, Field Programmable
- 9.6/14.4 KB Data Capability
- 3825 OBS
- CCITT Compatible

SKYLINE™ Series 9000 Radio



- Synthesized
- 6 Bandwidths up to 780 Channels
- 1.5 and 2GHz Operation
- Built in Bridging

ISC Cardion Electronics, Inc.
Member of International Signal & Control Defense & Space Group

895 Waverly Avenue, Holtsville, New York 11742
Tel.: 516-289-6200 TWX 510-228-2653 FAX 516-475-3568

Circle (88) on Fast Fact Card

New products

Sealed, lead-acid battery is rechargeable, rated 73Ah



The DM80-12 sealed, lead-acid battery from **Yuasa Battery** is rated at 73Ah and weighs 46 pounds. The rechargeable battery retains charge at 85% capacity after six months at 20°C. The 12V battery life expectancy is three to five years in standby use.

Circle (316) on Fast Fact Card

Rubber duck antennas fit portables, transportables

Seven rubber duck antennas from **Ora Electronics** are available for handheld and transportable cellular phones. The line includes four replacement antennas to use with various portables: Model CMS325 ¼-wave for Radio Shack CT-300 and Nokia-Mobira 500 series; CMS326 rubber duck for Oki CDL350; CMS327 for Motorola's 4000, 8000 and 9500 series; CMS328 12-wave rubber duck with SMA connector is an upgrade for Technophone and equivalent units.

Enhancement antennas suited for use with transportables include: CMS440 5/8-wave gain antenna for Radio Shack CT-200 and others; and CMS450 co-linear, high-gain antenna.

Model CMS480 is a two-piece convertible antenna with a ½-wave unity gain, but with a 5/8-wave radial, it becomes a 5dB gain antenna. It can be used for portables and transportables.

Circle (322) on Fast Fact Card



The Best Cellular NAM Programmer money can buy.

Introducing the **NAMPRO-300 MultiProgrammer**. Cellular Telephone Installers have never had it this **EASY**. With features including:

- 40-character alpha/numeric Liquid Crystal Display guides user thru menu of cellular telephone models & options.
- Step-by-step instructions display easy to read messages making the NAMPRO-300 the most easy to use programmer on the market today.
- Stores & recalls up to 32 Master NAMs.
- FREE Printer Port for permanent printout.
- Programs all 32 x 8 PROMs (NAMs).
- Plus, Full 1 Year Warranty



NAMPRO 3000
\$975.00 (U.S.)

FOR THE #1 CHOICE CALL:
1-800-523-1565
In FL: (407) 994-3520

BYTEK

BYTEK CORPORATION • Instrument Systems Div. • Boca Commerce Center
508 NW 77th Street • Boca Raton, FL 33487 • FAX: (407) 994-3615

Circle (89) on Fast Fact Card

SAVE TIME

For fast, accurate service, please remove the Peel-Off Label (which is used to address your magazine) and affix it to the Fast Fact Card, the Address Change Card, or to any correspondence you send us regarding your subscription.

Symptoms:

Johnson Trunking*
DCS
POC
Gokey
DTMF
CT Menu
NIC
Single tone
2 tone
3 tone
IMT
MTS
2300 pulses
202
ZVU
CCIF
EPD
*DTMF and Trunking

Rx: _____

CT SYSTEMS
Model 300
Universal Service Encoder
Use daily as needed!



At Last! A Cure For The Uncommon Code!



The CT Systems Model 300 is truly a Universal Service Encoder. Even trunking formats are included. Analog and Digital paging schemes are standard...as well as DTMF, DCS and Trunking Decode. The Model 300 is completely self-contained and ready to operate with internal battery, level control and high resolution LCD. Best of all, its flexible programming allows for future additions.

With all of this going for it, the CT Systems Model 300 Universal Service Encoder is nothing to sneeze at. And, at only \$795, you won't have to cough up a lot of money.

The answer to the question on page 17 is: The antenna is connected to the external horizontal port.

*Johnson Trunking is a registered trademark of E. F. Johnson Co.

CT SYSTEMS, INC.
5245 HORNET AVE.
P.O. BOX 470
BEECH GROVE, IN 46107-0470
800-245-6356
317-787-5721

New products

Sealed lead acid batteries range from 6V to 12V



Powerstar, a line of 24 maintenance-free sealed lead acid batteries is available from **Alexander** distributors. The line ranges from 6V with 900mAh to 12V with 38Ah. The captive electrolyte makes the batteries spill-proof.

Circle (306) on Fast Fact Card

Microwave power meter works with 1 diode sensor

The M14803A microwave power meter from **Anritsu** measures from 50MHz to 26.5GHz with one diode sensor. The unit features three power measurement modes: W, dBm and dB. Thermocouple sensors allow measurement from 10MHz to 32GHz, and quasi-millimeter and millimeter waveband sensors allow measurements from 17GHz to 140GHz. Differential measurements in decibels can be converted automatically and displayed as "% reflected power" or VSWR. All measurements are displayed on an LED display.

Circle (217) on Fast Fact Card

Test instrument proves glass-mount antenna performance

The KAV 850 window test kit from **Antenna Specialists** determines in a matter of seconds whether a specific automotive window with hidden metallic tinting films, owner-applied tinting kits or instant defrost options could substantially affect window-mounted antenna performance. The device also indicates optimum positioning of the mounting foot between defroster wires.

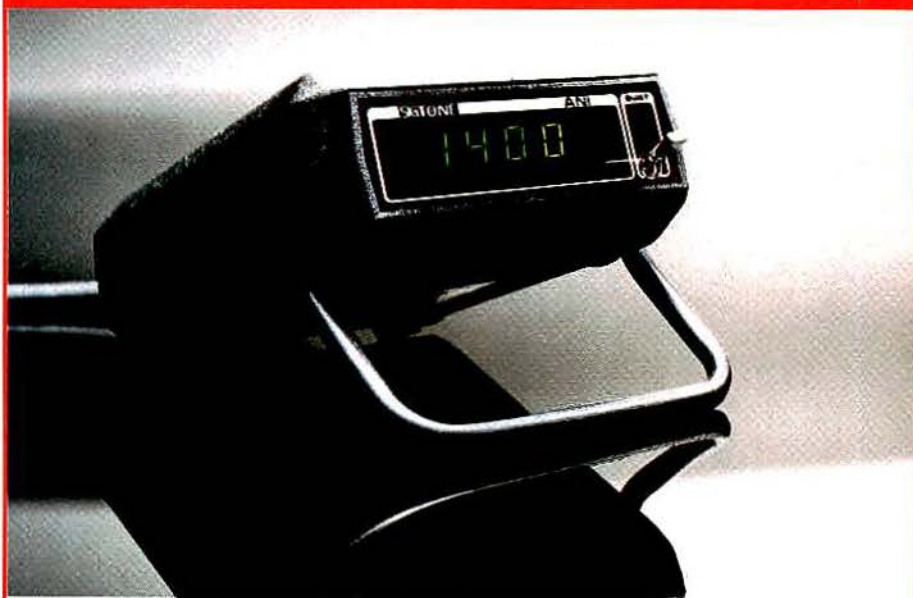


The window glass tester may be used with any inexpensive hand-held digital capacitance meter capable of 1pF measurement with 0.1pF resolution. Designed through correlation with actual RF measurements, the probe works for cellular telephone, trunked and dispatch radio applications. It may be used to troubleshoot problems in existing installations.

The kit includes a capacitance pickup and probe combination, cable harness and pickup wire for grounding.

Circle (264) on Fast Fact Card

Affordable efficiency



SIGTONE'S new Automatic Number Identification (ANI) offers you a low-cost opportunity to vastly improve the efficiency of your mobile radio fleet operations:

- Immediate identification of caller
- Elimination of lengthy voice call establishment procedures
- Automatic alarm sequencer - providing improved driver safety
- Up to 10 selectable status functions
- Can be hooked into your computer/printer for recording purposes
- Plus many other features and benefits.

Sigtone's 5-Tone Sequential code plus a variable sixth status tone offers you up to 100,000 address codes plus 10 status functions with superior decode reliability and NO FALSING. The transmission time for an ANI code is just 1/10th of a second. Installation is simple. Absolutely no system alignment or equipment adjustment necessary. Sigtone's ANI is very flexible and can be adapted to suit many applications. You will be surprised how affordable it really is, so contact Sigtone today for further details.

SIGTONE

Sigtone, Inc. Sunset/Vine Tower
Suite 1126, 6290 Sunset Blvd
Los Angeles CA 90028-8770
Tel (213) 463-4474 Fax (213) 463-4319
Toll-free (800)-LA5-TONE (outside California)

Sigtone, Inc. specialises in high quality, high performance, tone signalling products for radio communication.

Doc. No. 14-00-26/1 ISS A

Circle (92) on Fast Fact Card

If you're looking for a
cellular soft pack
that moves...

Continental CELLPAC

Continental Leavitt's new Cellpac has all the features you're looking for in a soft pack transportable. Use it with any Motorola® Minitac® including Motorola's new "KS" phone. Take it with you wherever you want to go. Buy it with or without the phone.

State of the industry features include:

- Lightweight, easy to operate design
- Durable, water repellant soft pack material
- Up to 70 minutes of talk time or 8 hours of standby or any mix
- Factory quality parts/construction
- Antenna protection—no broken connectors or floppy antennas
- Competitive pricing

Accessories Included

- Antenna and "L" adapter
- Nylon 1200 denier, soft bag, wiring harness & assembly plate
- Cigarette lighter charging cord

Optional Accessories:

- 3 amp hour sealed lead acid battery
- 1.5 amp hour AC wall charger for battery charging
- 3.5 amp hour AC power supply for office or home operation
- Private labeling



Specifications

Weight: Phone and pack 4 lb. 10 oz.
Dimensions w/case: 12½" L
× 6½" W × 6" H including
external pouches
Shoulder strap included

Cellpac can be
operated with or
without a battery and charger.*

** sold separately*

CALL (312) 982-0220

Continental Leavitt Communications, Ltd.

SALES AND SERVICE OF MOBILE COMMUNICATIONS

5115 CHURCH STREET • SKOKIE, IL 60077





N Female to
Mini UHF Male



UHF Male to
UHF Male



BNC Female to
Mini UHF Male


ONE KIT DOES ALL THIS




Mini UHF Female to
N Male



UHF Female to
BNC Male



N Female to
BNC Male



N Male to
BNC Male



N Male to
BNC Female



UHF Female to
Mini UHF Male



UHF Male to
TNC Female

New products

Coaxial cable has solid center conductor

Coaxial cable distributed by NCG has a solid copper center conductor. The 5D-FB 50 Ω coax has PEF insulation, a foil wrap, TFE insulation, full braid and a black PVC weather jacket. Recommended type N connectors also are available for the coax.

Circle (187) on Fast Fact Card

Lightning protectors guard RF installations

A series of lightning protectors from Arcturian Trading boasts a rise time of better than 2ns. Available fittings include UHF and N connectors in plug and socket configurations or a combination of both.

Circle (307) on Fast Fact Card

SET EPROM programmer doubles as gang duplicator

Bytek's SI25-EG is a SET EPROM programmer and a gang EPROM duplicator. It is compatible with the Data I/O 288, though some differences may be evident in certain applications.

Circle (187) on Fast Fact Card

Digital trunking system suits 900MHz

General Electric makes a digital trunking system for business and industrial use on the new 900MHz frequencies. The system offers roaming operation on multiple sites and the capability to reprogram equipment as needed for additional capacity.

Circle (299) on Fast Fact Card

Omni gain antennas cover four bands

Nine models of omnidirectional gain antennas have been introduced by Decibel Products. The antennas use a centered collinear design with elements enclosed in a fiberglass radome. The electrical design uses a series of low-loss flat radiators isolated from each other by the use of choke-controlled phase-shifters. The center feed controls beam-tilt and VSWR across each operating band. The radome material is Aeroglas, a fiberglass first developed for helicopter rotors, vaulting poles and sailboat masts. The antennas are provided with jumpers, connectors, clamp sets and hardware.

Model DB506 covers 118MHz to 174MHz with 5.25dB gain. Model DB506M covers 156MHz to 162.5MHz with 5.25dB gain. Model DB536 covers 380MHz to 512MHz with 6dB gain. Model DB538 covers 380MHz to 512MHz with 8dB gain. Model DB540 covers 380MHz to 512MHz with 10dB gain. Model DB553 covers 806MHz to 960MHz with 7.5dB gain. Model DB557 covers 806MHz to 960MHz with 9.5dB gain. Model DB560 covers 806MHz to 960MHz with 10dB gain.

Circle (230) on Fast Fact Card

Pagers earn safe rating

Monipage pagers made by **Shinwa** come with an intrinsically safe rating as determined by an independent testing laboratory. Models SR36VT, SR46VT and SR56VT meet the requirements of ASNI/UL/NFPA 4913 standard for intrinsically safe apparatus for use in Class 1, division 1, groups A, B, C and D hazardous locations. The pagers have a T6 temperature range.

Circle (192) on Fast Fact Card

NAM programmer adapter works with Philips FM-9000

An adapter from **Curtis Electro Devices** connects to the serial port of the company's PR5200B Universal NAMMER. It allows reading the programming the number assignment module (NAM) for the Philips FM-9000 cellular mobile telephone. The adapter allows reading of the telephone's electronic serial number.

Circle (193) on Fast Fact Card

Manual paging encoder has 1,000-call capability

The MT-1000 software-based manual paging encoder from **CTI** includes all Motorola code plans, the GE type 99 plan and optional RPC1 (formerly POCSAG) digital or RPC1 digital display. The encoder attaches to any base station. It comes in a rugged metal chassis with improved RF immunity. Additional features include 1,000-call capability, pager transfer and digital display of unit encoding.

Circle (194) on Fast Fact Card

Coating for towers helps to prevent icing

The super hydrophobic coating system from **Vellox** includes an aqueous primer system and top coat. Together, the primer and top coat repel water to help keep towers and antennas free from icing. The ingredient in the top coat that repels water is an extremely fine-treated powder. The small particle size and repellency, when applied to a surface, keeps water from reaching the inner surface. The top coat, when applied over the primer, greatly assists in eliminating icing and dirt accumulations on antenna structures and similar systems in severe weather.

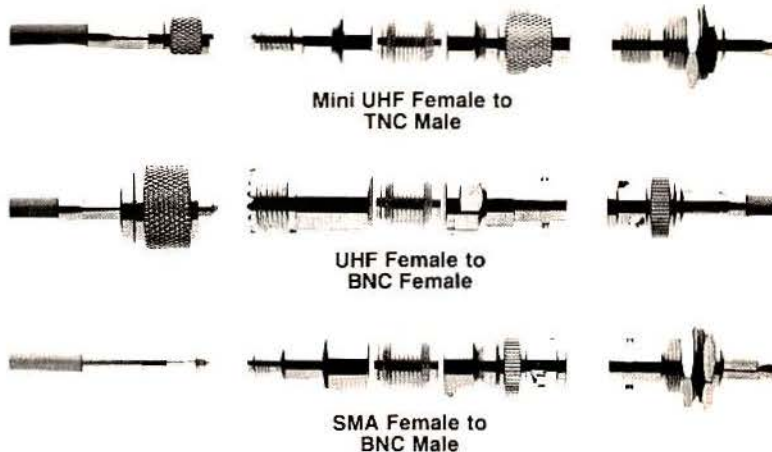
The primer may be applied by any conventional means. The top coat should be applied with a sprayer to achieve a uniform coating. Standard spray equipment is used to apply the top coat.

Circle (340) on Fast Fact Card

Dispatchers can assign channel to display module on console

The Centracom series II plus display channel control module (DCCM) from **Motorola** allows console reconfiguration by talk-group or channel assignment to a display module. Assignment can be completed by scrolling to the desired channel or talk-group or by entering the appropriate group's number on the console. Each DCCM has a built-in diagnostic mode and is equipped with an eight-character LED alphanumeric display.

Circle (341) on Fast Fact Card



UNIDAPT®

The
Incredible
Adapter
Kit!



This little plug is the key to *hundreds* of adapter combinations. Just choose two UNIDAPT connector ends and screw them together with the plug.

Forget about ever digging through a jungle of adapters only to find out you're missing the one you need. With UNIDAPT you'll never be stranded at a worksite without the right adapters.

The UNIDAPT kit comes with 24 common male and female connector ends and 6 universal plugs. Mix and match to create the adapter you need, when you need it.

Engineers love us. Field technicians thank us. And at \$124.95, you'll wonder how you've gone so long without one! To order, call the RFI distributor in your area, or 1-800-233-1728, or 619-587-0656 in California.

Kit includes 2 male and 2 female UHF, Mini-UHF, N, TNC, BNC, and SMA, plus 6 Universal Plugs.

RFI
INDUSTRIES

A division of Celltronics
10040 Mesa Rim Road • San Diego, CA 92121
1-800-233-1728 • 619-587-0656

Now for BIRD and TELEWAVE Wattmeters



Screw our Unidapt Wattmeter Connector to your RF wattmeter, then choose any male or female connector end from your UNIDAPT Kit. What a time saver!

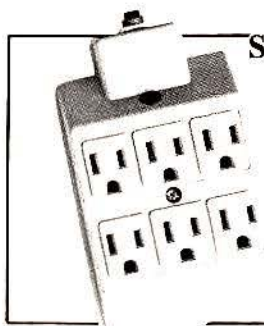
Circle (95) on Fast Fact Card

New products

FCC data research is available

The American SMR Network Association is offering FCC data research. Three general categories of information are license inquiries, geographic services and database reports. Frequency reports available include state-by-state reports of SMR channels or "circle searches" by frequency pool.

Circle (206) on Fast Fact Card



Surge protector ensures six protected outlets

The SP-6-CB surge protector from Spi-Ro Manufacturing has an EMI/RFI filter and surge suppressor that is UL listed. It is rated at 15A, 125V and 60Hz. The unit provides Nanosecond switching response time, and maximum spike current is 4,500A. The unit provides six protected outlets and has a resettable circuit breaker and an indicator light.

Circle (270) on Fast Fact Card

RF POWER

One Billion Watts In Stock

Make RF Gain your one stop source for RF Power Tubes and Transistors.

We have the largest inventory of RF Power Transistors and Electron Tubes cross-referenced to OEM part numbers, along with Amplifiers/Converters-Portables and Closed Circuit Television for the communications industry.

Plus we ship 90% of all orders the same day they are received.

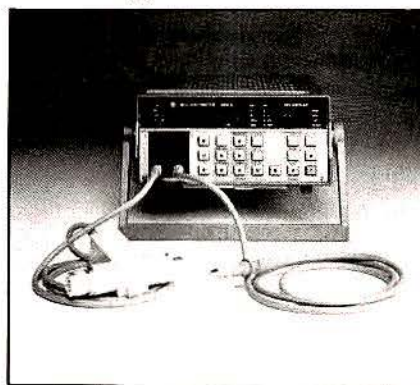
RF Gain, Ltd.

A Richardson Company

116 South Long Beach Road
Rockville Centre, NY 11570
(516) 536-8868; (800) 348-5580
Telex: 6852380; FAX: (516) 872-4450
Corporate Headquarters:
(312) 232-6400; (800) 323-1770

Circle (96) on Fast Fact Card

Instrument measures dc, RF voltage to 2GHz



Model URV5 millivoltmeter from Rohde & Schwarz is a dual-channel, three-in-one precision tester. It can measure dc voltages to 400V; high-impedance voltages from 20kHz to 1GHz; through-line coaxial RF voltages from 9kHz to 2GHz; and power levels, 50Ω to 75Ω, from 1MHz to 18GHz. The tester automatically senses the probe or sensor in use and displays the measured results digitally. Each channel can be displayed separately.

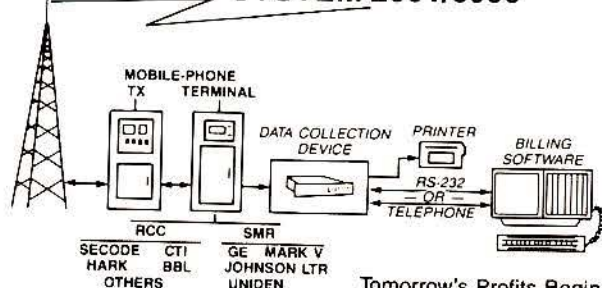
Circle (180) on Fast Fact Card

Messaging system handles 10,000 subscribers

The PX Sprite from Spectrum Communications and Electronics combines paging, voice messaging and operator-assist services in one terminal. The messaging system supports up to 10,000 subscribers on up to two discrete channels. Features include voice mail for up to 27 hours of storage; alphanumeric entry using pseudo-voice recognition techniques; simultaneous multilanguage voice prompts; and channel sharing with established paging providers. The system is designed for small operations.

Circle (162) on Fast Fact Card

SYSTEM 2001/3000



Tomorrow's Profits Begin With Today's...

IDEAL

(912) 333-0726

P.O. BOX 1203, VALDOSTA, GA 31601

Circle (97) on Fast Fact Card



© 1988 Allied Signal Inc.

TOUGH CUSTOMER.

We've always made a rugged, dependable communications system. But our new MPH VHF handheld is so tough that it meets MIL 810 C & D specifications, passes the U.S. Forestry Service vibration test and exceeds EIA RS316B shock and vibration standards.

The MPH has a die-cast frame and all-metal case for enhanced structural integrity. Its "O"-ring gasketing cushions against shock while it seals out moisture and dust. Its toggle switches and LEDs are protected by silicone boots. And this tough customer is backed by our comprehen-



sive warranty, one of the strongest in the industry.

In addition, you know you're getting top-of-the-line communications performance, along with a host of built-in features. Like Bandtrac™ tuning (148-174 MHz), allowing you to cover the complete band with no degradation in specs; and Code Guard™ squelch (CTCSS & CDCSS) scan and priority scan.

Put it all together and you've got a portable VHF

radio that can handle your most demanding communications assignments. But maybe the most impressive thing about our new MPH is that something so tough can be so easy on your budget.

For more information about the MPH-series portable, contact Cliff Casler at 913/842-0402, or write:

BENDIX/KING

Mobile Communications Division
2920 Haskell Ave., P.O. Box 3347
Lawrence, KS 66046
In Canada, contact John Eaton, 416/831-6333

Allied-Signal Aerospace Company

VISIT US AT EXPO EAST

**Allied
Signal**

Circle (98) on Fast Fact Card

New products

450mAh, 500mAh batteries boast smaller cases



The J/BP4 batteries have been redesigned with smaller cases. The JaBro batteries are available in 450mAh and 500mAh and are rated at 11.25V. The redesigned cases are gray, but the original red case is available upon request.

Circle (321) on Fast Fact Card

Guyed tower comes with 24-inch face

Model 2400 solid steel guyed tower from Western Towers features a 24-inch face. The structural design exceeds EIA requirements, and the tower is designed to withstand winds up to 150 mph. Towers requiring higher wind or ice loads are custom-engineered.

Circle (225) on Fast Fact Card

Module includes privacy, ANI, status reporting

The SC-460 module from Transcrypt International features voice privacy, ANI, status reporting and selective calling. Smaller than two postage stamps, the unit fits in most radios, including portables. The module's voice privacy offers more than 100 trillion key codes and a four-digit ANI with 10 fleets and 100 groups.

Circle (310) on Fast Fact Card

Two-way portables meet simple communications needs



The Radius P10 and P50 two-way portables from Motorola offer CTCSS and DCS to reduce co-channel reception. Model P10 features single-channel, low-power operation in UHF and VHF. P50 is available in 2W or 5W models in VHF and 1W or 4W in UHF; it also offers one- or two-channel operation.

Circle (209) on Fast Fact Card

Carry a multi-million dollar inventory without spending a dime.

With one phone call, you can get anything from our (your) multi-million dollar inventory within 24 hours. With one phone call, you get access to good sales and technical help. With one phone call, you expand your capabilities. That's the advantage of being a Primus customer.

Call today, without spending a dime, for our line card, quotes, or to get on our mailing list.

Primus... the land-mobile distributor that's an extension of your business.



primus

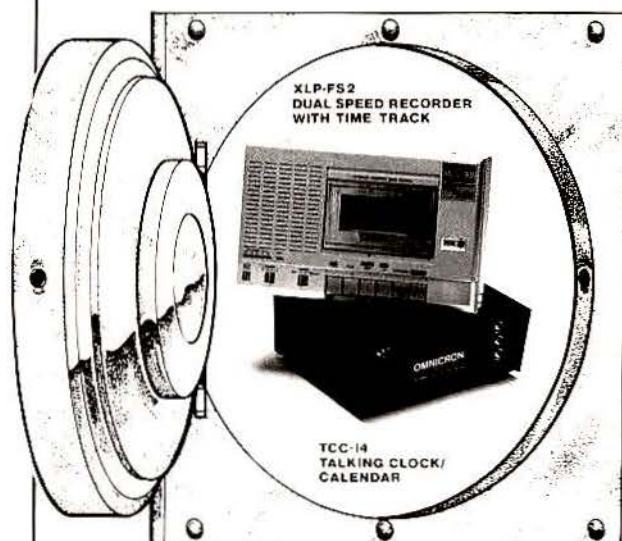
ELECTRONICS CORPORATION
18424 South I-55, West Frontage Road, Joliet, IL 60435
Out of state: 1-800-435-1636 Illinois: 1-800-892-1413



uniden

Circle (99) on Fast Fact Card

LOCK UP YOUR CONVERSATIONS



Gather and store messages the sensible way. Omnicron recorders provide automatic documentation of your important conversations—telephone, two-way radio, etc.—from \$330.

- Automatic voice activation
- Up to 16 hours of talk time on a standard audio cassette, with time and date on a separate track
- Full line of accessories
- Easy installation
- Fail safe alarms prevent operator error
- One button instant review of messages



**OMNICRON
ELECTRONICS**

1 MECHANICS STREET
P.O. BOX 523
PUTNAM, CONNECTICUT 06260-0523
(203) 928-0377

Circle (100) on Fast Fact Card

When more than the bottom line is on the line

There are few second chances in your business. When you need to reach your mobile, you need to reach it the first time, every time. Excuses won't wash. And that's precisely what Quintron simulcasting is all about.

A Quintron simulcasting system gives you better wide area coverage, better penetration into and through buildings, and better signal quality. You get improved reach, response and voice clarity.

Simulcasting is the simultaneous broadcast of identical signals from multiple transmitters, so that a clear, strong signal can be received anywhere within an area. A simulcast system is customized in a way that complements local topography to overcome interference and signal

loss conditions. A Quintron simulcast system features top quality, highly reliable and dependable equipment designed specifically for simulcasting — by the one company to demonstrate successful simulcasting and first develop it commercially.

Why take a chance when you can choose Quintron simulcasting? Especially when over the long run Quintron equipment makes so much sense on the bottom line, too.

Contact the company that has built and installed more simulcast systems worldwide than any other; the company that knows more about simulcasting for two-way mobile than anyone else: Quintron.

*QUINTRON and you . . .
The partnership for success*



One Quintron Way P.O. Box 3726
Quincy, IL 62305 Phone 217-223-3225

QUINTRON

Circle (101) on Fast Fact Card

New products

Coaxial terminations fit 50Ω, 75Ω and 93Ω lines

Six resistor plugs terminate coaxial lines in any of three impedances, 50Ω, 75Ω and 93Ω, and for types BNC and TNC, the resistor-terminated plugs may be used at frequencies as high as 4GHz with a maximum VSWR of 1.3:1. **Cambridge Products'** units are color-coded for ease of identification. Typical uses include line terminations in isolators, circulators and directional couplers.

Circle (255) on Fast Fact Card

Cellular units accommodate two telephone numbers

The 400 series cellular telephones from **Nokia-Mobira** have been enhanced with dual telephone number capability. Models include the 412 trans-portable, the 422 mobile and the 432 combination. Older 400 models can be upgraded.

Circle (303) on Fast Fact Card

Mobile channel simulator creates Rayleigh conditions



The mobile channel simulator from **Matcom Trading** duplicates a variety of mobile conditions including Rayleigh, lognormal and Rician channels spanning 450MHz to 1GHz.

Circle (319) on Fast Fact Card

AVL system enhances dispatch decisions

The FleetControl automatic vehicle location (AVL) system from **Repco** features computerized tracking and dispatching. On a color monitor, the system displays the status, location and speed of every fleet vehicle on an area map, enabling dispatchers to pinpoint the vehicle best able to respond to a call. The tracking is a dead-reckoning system with a CRT connected to an on-board computer that communicates with a central station via radio. The system is updated continuously by vehicle sensors.

Circle (314) on Fast Fact Card

Numeric display pager holds 16 messages

The PG 900N 900MHz numeric display pager from **Uniden** features selective message deletion, 16-message storage, memory full indication, two cap-codes and eight addresses, battery-saving circuitry and status indicators.

Selectable alerts include flashing light, soft beep, loud beep and vibration. It uses the RPC1 (formerly POCSAG) paging format.

Circle (198) on Fast Fact Card

CELWAVE

Cablewave Systems



- Fast delivery.
- No minimum buys.
- Expertly installed connectors.
- Complete selection of connectors and installation accessories.

TESSCO

Your Total Source™

DIRECT ORDER HOTLINE

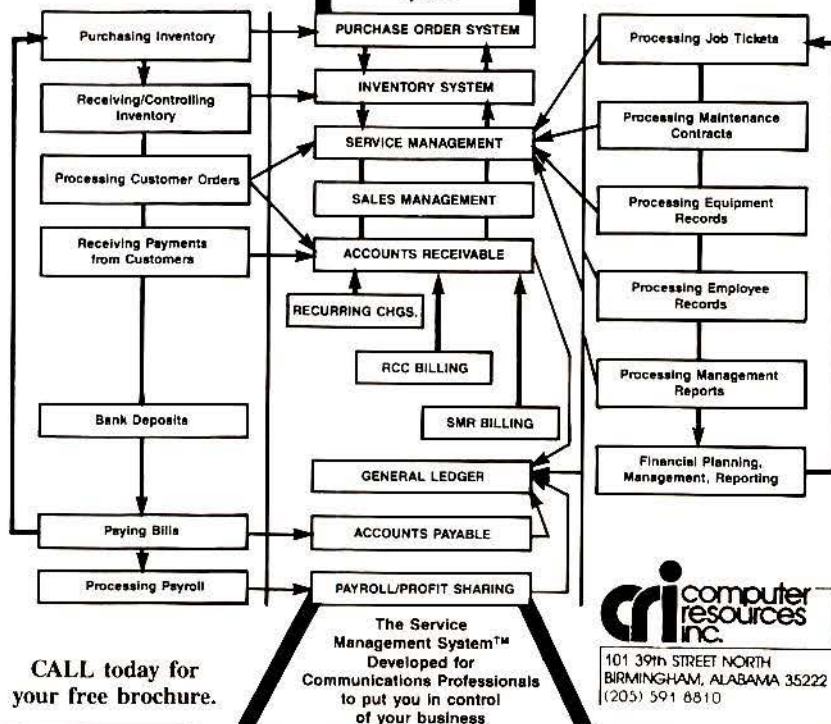
800-638-7666

Touch 2

GC8

Circle (102) on Fast Fact Card

COMPUTERS FOR THE COMMUNICATIONS INDUSTRY



Circle (103) on Fast Fact Card

Rechargeable system powers headsets



A rechargeable power system for **Ear-mark** series 3 and 3W headsets comes with a plug-in power source, a four-pocket charger and two or four rechargeable battery packs, depending upon user requirements. The nicad-powered accessories provide full operating capability for eight hours of continuous transmit and receive. Installation of the battery packs is simple and takes less than one minute. All existing waterproof seals are preserved for environmental integrity.

Circle (284) on Fast Fact Card

Mobile can be expanded up to 128 channels with scan



The mobile versatile synthesized (MVS) radio from **General Electric** is modular and can be upgraded from its basic two-channel operation to a maximum of 128 channels with dual-priority scan. The mobile meets MIL SPEC 810C and D, as well as EIA and Forest Service specifications. The MVS tests itself each time the "on" button is pressed. The unit is designed to meet growth in operational needs.

Circle (215) on Fast Fact Card

ACSSB synthesized radio offers scanning, priority

The Pioneer ACSSB synthesized trunk-mount VHF transceiver features 96-channel capability and scan with priority. It boasts a 7MHz bandwidth, 12W of audio, EEPROM programming for frequency and CTCSS tones, and

front-panel programming of scan and priority channels. The **Aerotron** unit has built-in servicing test routines and a modem interface for data transmission.

Circle (205) on Fast Fact Card



This communications test set goes from factory to field!

Pile the battery-operated and light weight STABLOCK 4031 into a jeep and take it to a mountaintop bay station. Its 2 μ V RF sensitivity even allows off-air measurements! Or take full advantage of versatile built-in test routines, 100 stored panel setups, and integral IEEE-488 interface for factory servicing and calibration.

Other features include:

- Cellular capability
- Duplex demodulator
- Off air measurements
- Program storage

- Hi-resolution zoom graphics
- 1000 MHz spectrum analyzer

Let our 25 years experience in radio communication measurements make your job a little easier. Call today for a demonstration of the exciting 4031.

Schlumberger Instruments

20 North Avenue Burlington, MA 01803
Telephone: (617) 229-4825
Toll Free (Outside MA): 1-800-225-5765.

Schlumberger

Circle (104) on Fast Fact Card

New products

Crystal-controlled portables cover three frequency ranges



The RP portable radios from **Regency Electronics** cover three frequency ranges: the RPL for lowband operation; the RPH for VHF highband; and the RPU for UHF. The RPL has 5W RF output with as many as four channels; the RPH offers 5W to 6W with six channels; and the RPU has 2W to 4W with four channels. All portables are crystal-controlled, and VHF units are switchable to 1W.

Circle (392) on Fast Fact Card

Encryption device achieves voice, data security

The CSD 3324A digital secure voice system from **Technical Communications Corporation** provides voice and data communications security. It secures voice over cellular telephones, microwave and satellite links, and telephone lines. In the data mode, the unit operates with Group III Fax, Telex and asynchronous or synchronous RS-232 data up to 2,400bps.

Circle (391) on Fast Fact Card



Metal-mesh plates boost replacement battery capacity

Energy Plus batteries from **Energy Concepts** boast as much as 40% more capacity than original manufacturer equipment. The cells are based on a new technology involving woven, metal-mesh plates instead of scintered, perforated nickel plate. The larger surface area offered by the metal mesh results in the greater capacity without an increase in the size of the battery case.

For example, a replacement battery for the Motorola MX 1,200mAh battery typically has a 1,700mAh capacity. Some of the replacements of the same size show capacities as great as 1,800mAh.

Energy Plus batteries are available to replace original equipment batteries made by General Electric, Motorola, Recco, Standard, TacTec and Wilson, with other models yet to be introduced.

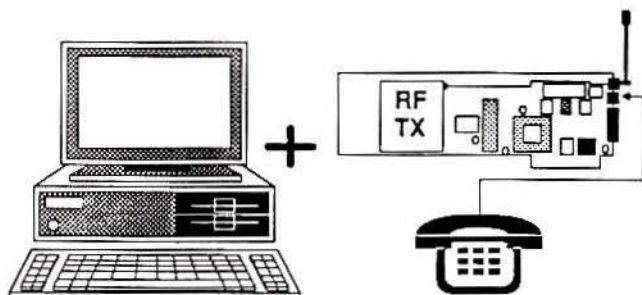
Circle (389) on Fast Fact Card

MICRObeep

The ONLY Complete Single board PC based paging system!

MICRObeep operates completely in the background of your PC while supporting standard digital paging formats. Available with a telephone interface for page entry, built-in RF transmitter & multiple alarm inputs,

MICRObeep is powerful in-house paging — at an affordable price!



MICROLINK INC.

100 East NASA Road One

Phone: (713) 488-6011
FAX: (713) 554-2499
Telex: (ITT) 494-8285

Webster, Texas 77598

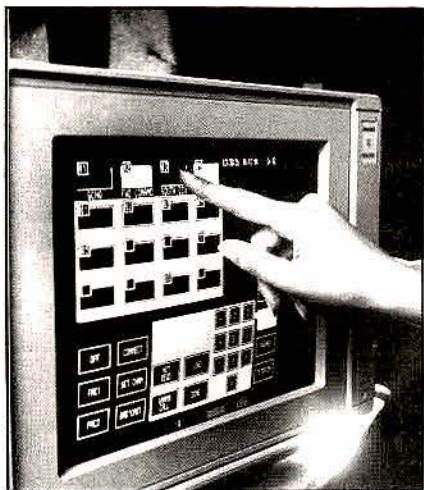
Circle (105) on Fast Fact Card

Battery-saving circuit is built into portable

The TK-320 UHF synthesized portable from **Kenwood** has 2W RF output, adjustable to 4W. The 16-channel unit offers a wide frequency spread and has a built-in battery-saving circuit. The hand-held is lightweight. Optional heavy-duty battery packs are available. A DTMF version is offered.

Circle (288) on Fast Fact Card

Control system features modular design



The DX 2000 communications control system from **Philips RCS** consists of the DX 2000 CE common equipment, the DS 250 touch-panel workstation and the DS 2000 touch-screen workstation. The DX 2000 CE control switch provides terminations for 100 channels and supports 99 operator workstations. Any channel can be routed to any workstation where the operator can control the facilities on that terminated channel. The operator also can control functions on external communications equipment such as transmit, talk-through and mains/standby power.

The DS 250 workstation mounts on a desktop or console and has an audio panel for controlling volumes and transmit and receive switching. It offers five channel-access panels to control facilities on as many as 25 channels.

The DS 2000 touch-screen operator workstation offers full control over the switching and monitoring of channels by touch. Operator intercom is optional.

Circle (287) on Fast Fact Card

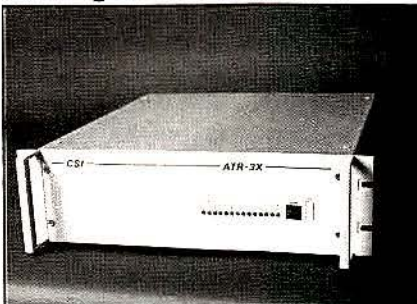
Antennas provide broadband directional gain



The Log Periodic antennas from **Transcrypt International** are lightweight and easy to carry and can be deployed in less than a minute. They offer maximum range extension for hand-helds and base stations and provide broadband directional gain. The antennas are designed for tactical, VHF/UHF communications and are available in several versions to cover frequencies from 100MHz to 900MHz.

Circle (243) on Fast Fact Card

Data transceiver extends coverage via shortwave



The ATR-3X automatic HF data transceiver from **CSI Communications Systems** is a self-contained, 125W narrowband digital transceiver designed to extend data communications to locations where conventional data transmission systems are not economically feasible. The synthesized unit operates at 300 baud with error correction and unlimited addressing. The 1.6MHz to 30MHz radio provides coverage in excess of 2,500km in network application where omnidirectional coverage is needed and coverage in excess of 5,000km in point-to-point systems.

Circle (188) on Fast Fact Card

RISER-BOND INSTRUMENTS

Your TDR Source



MODEL 2901B

DIGITAL TIME DOMAIN REFLECTOMETER
CABLE FAULT LOCATOR

- OSCILLOSCOPE OUTPUT CAPABILITY
- VARIABLE SENSITIVITY CONTROL

AND ONLY \$795⁰⁰ COMPLETE

TESSCO T.M.

Your Total Source®

DIRECT ORDER HOTLINE

GR8

800 638-7666

Circle (106) on Fast Fact Card

AUTOMATIC RADIO STATION CW IDENTIFIER



MODEL 813A

- MULTI-MODE OPERATION
- CHANNEL IN-USE INHIBIT
- REPLACEABLE CALLSIGN
- MINIATURE SIZE 1" x 4"
- ONE YEAR WARRANTY

only \$74.95*

*Add \$3 shpg/hdlg PLUS \$2 for c.o.d.
CA res. add sales tax

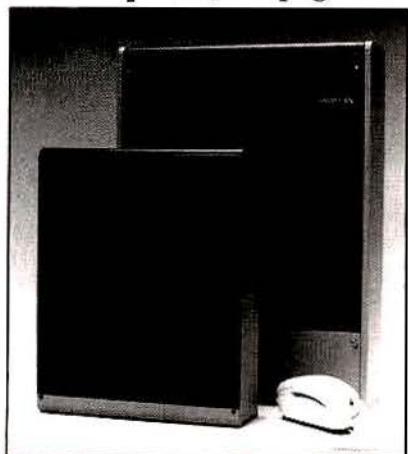
Securitron Co.

PO Box 32145 San Jose, Ca. 95152
Phone (408) 263-6434

Circle (107) on Fast Fact Card

New products

Multitrunk paging terminal handles up to 2,500 pagers



The Zetron 2100 multitrunk paging terminal has voice storage and offers voice prompts for messaging. The terminal contains voice mailbox and call accounting features. It handles as many as 2,500 pages, two to eight telephone inputs and one or two radio outputs.

Circle (197) on Fast Fact Card

Generator, spectrum analyzer are part of tester package

Model 5100S communications service monitor from CT Systems has a wide range of features, including spectrum analyzer, full duplex/offset generator, tone and digital encoder-decoder, storage and recall registers, built-in self diagnostics and a full-sized computer-style keyboard.

Circle (228) on Fast Fact Card



Voice security includes busy-channel lockout



The KRC-2000 security system from Kryptic includes a digital rolling code scrambler with ANI, emergency call, selective call and busy-channel lockout. The system features are incorporated in the company's line of radios and base stations, and in miniature plug-in modules or mobile mics for use with existing radio systems. Duplex models are available for IMTS, cellular and trunked systems.

Circle (317) on Fast Fact Card




DON'T GET BENT OUT OF SHAPE OVER QUARTZ CRYSTALS

800-327-1282

Savoy
ELECTRONICS, INC.

1937 - 1987
50 Years of QUALITY

P.O. Box 5727, Fort Lauderdale, FL 33310
TEL 305-563-1333 • FAX 305-563-1378

Circle (108) on Fast Fact Card

BEE LEATHER CASES
FOR PORTABLE
RADIOS • PAGERS & INSTRUMENTS

GENUINE FULL GRAIN LEATHER

FREE Imprint of your trademark with your order of 25 cases or more, in a variety of colours



Protect your investment of a portable Radio or Pager for longer and safer life, with genuine leather hand crafted cases available in various colours and textures. For added protection, custom logo cases with your company trademark. Cases for most popular models always in stock. Most orders shipped same day.

BEE ELECTRONICS INC.
2655 Gardner Rd. Broadview, Illinois 60153
(312) 345-0337 • Toll Free 1-800-336-3115

Circle (109) on Fast Fact Card



Outlook Corporation

(TAIWAN INC.)

MANUFACTURER OF VHF-UHF COMMUNICATIONS & ACCESSORIES



BASE—MOBILE—PORTABLE ☒

VHF 30—174 MHz ☒
VHF 200—250 MHz ☒
UHF 300—380 MHz ☒
UHF 390—512 MHz ☒

ALL YOU EVER NEED
FROM ONE SOURCE ☒

EXCLUSIVE
AGENCIES AVAILABLE ☒

FULL LINE OF ACCESSORIES ☒

SALES & SERVICE CENTERS
USA & WORLDWIDE ☒

OEM INQUIRIES WELCOME ☒



OUTLOOK
INTL. SALES & SERVICE OFFICE
3909 SOUTH MARYLAND PARKWAY, # 402
LAS VEGAS, NEVADA 89119
TEL: (702) 731-1516
TLX: 180051 LSV, 298767 BIGHQ
FAX: (702) 731-3154

FACTORY:
P.O. BOX 101-25
TAIPEI
TAIWAN R.O.C.

**SPECIALIZED
TO MANUFACTURE
PRODUCTS FOR
THE O.E.M.
INDUSTRY**

Circle (110) on Fast Fact Card

ALL YOUR COMMUNICATION NEEDS

HF 0.1—30 MHz, VHF 30—250 MHz, UHF 300—512 MHz

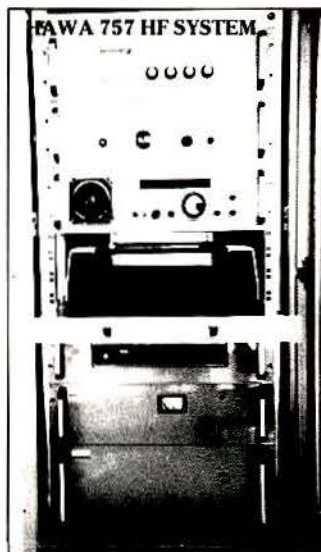
AM—FM—SSB

EXCLUSIVE AGENCIES AVAILABLE

OEM LABELS WELCOME

PRICE & QUALITY
THE PERFECT MATCH

OTHER HAWA PRODUCTS: 19" RACKS,
ENCLOSURES, CUSTOMIZED INTEGRATED
SYSTEMS COMPONENTS, PARTS FOR O.E.M. AND
INDUSTRIAL USE.



MOBILE TRANSCIVER



BASESTATION



HANDHELD TRANSCIVER



FACTORY, INTL. SALES & SERVICE, CORPORATION HQ's*
HAWA USA INC.
3909 SOUTH MARYLAND PARKWAY, #408
LAS VEGAS, NEVADA 89119

TEL: (702) 731-4776
TLX: 298765 HAWAUR
FAX: (702) 731-3154

Hawa Worldwide Subsidiaries & Service offices include: W. Germany, Switzerland, France, England,
Scandinavia, Italy, Middle East, Africa, South America, Taiwan, Thailand, Singapore, Hong Kong, and Japan.

Exclusive Agencies Available!

***ASK FOR THE NEAREST HAWA SUBSIDIARY**



Circle (111) on Fast Fact Card

Publications review test equipment

Marconi Instruments has released publications that offer details about the company's test equipment.

□ "Marconi White Noise Testing of Frequency Division Multiplex Systems, A Guide to Choosing Your Test Equipment" describes white noise testing, a combination of a noise generator and

noise receiver, designed to test the performance of communication links with a test signal that simulates actual transmitted traffic.

Circle (400) on Fast Fact Card

□ "Marconi 400MHz Spectrum Analyzer 2382 Brochure" details and illustrates model 2382 400MHz spectrum

analyzer with associated display and its RF design that offers accuracy, stability and high resolution.

Circle (401) on Fast Fact Card

□ "Marconi Instruments 2022A 10kHz to 1GHz Signal Generator Brochure" describes its latest addition to its line of portable, economical signal generators. The brochure details specification improvements and operational features.

Circle (402) on Fast Fact Card

□ "2022A and 2022C Signal Generators Bulletin" describes two synthesized signal generators designed for fast operation locally or over the GPIB.

Circle (403) on Fast Fact Card

□ "2380 Series Spectrum Analyzers with Tracking Generators" explains the features of models 2382 and 2383 spectrum analyzers. It includes a chart that outlines the two generators' specifications.

Circle (404) on Fast Fact Card

□ "100Hz to 4.2GHz Spectrum Analyzer and Display" is a brochure about model 2383/2380 test instrument. It covers the units' general philosophy, GPIB capabilities, markets, horizontal scales, receiver modes (zero span, FM demod and meter mode), vertical scales and display and storage.

Circle (405) on Fast Fact Card

□ "2440 Series Microwave Counter" is a brochure that describes model 2440, which has a frequency range of 10Hz to 20GHz, and model 2442, which has a frequency range of 10Hz to 26.5GHz. The instruments boast an acquisition time of 200ms for microwave signals. A specification summary page outlines additional features and accessories.

Circle (406) on Fast Fact Card

□ "Mobile Radio & Cellular Radio Communications Test Products Short Form Catalog" covers model 2955 radio communications test set and model 2957 cellular radio test set. It details accessories available and typical system applications.

Circle (407) on Fast Fact Card

□ "Marconi Instruments Short Form Catalog" reviews spectrum analyzers,

MAGNUM

THE EAR-MIKE™ SPECIALIST

EM-200 EAR-MIKE™

- For complete flexibility
- Many Standard Features
 - I.S. Approved



NEW EM-150 EAR-MIKE™!

- A cost effective alternative
- Hard wired interface cable
 - Attaches to most radios

ALLOWS YOU TO TALK THROUGH YOUR EAR!
But remember,
If it's not from MAGNUM... it's not an EAR-MIKE™!

FOR MORE INFORMATION CONTACT:

MAGNUM DISTRIBUTION

U.S.A. Office
264 H Street
P.O. Box 8008
Blaine, WA 98230-8008
Tel: (206) 676-7775
Fax: (604) 270-2138

**International
Head Office**
102-11400 Bridgeport Road
Richmond, B.C. Canada V6X 1T2
Tel: (604) 270-1389

Circle (112) on Fast Fact Card

scalar analyzer systems, microwave sweepers, microwave signal sources, signal generators, modulation analyzers, microwave counters, power meters, power sensors, white noise test sets, mobile and cellular radio test sets, transceiver test system, TV test system and GPIB adapters.

Circle (408) on Fast Fact Card

Nicad battery technical book includes specification tables

A 52-page book providing technical data on the Cadnica family of sealed, rechargeable nickel-cadmium batteries is available from Sanyo Energy. Nine chapters cover batteries in general, charge characteristics, discharge characteristics, storage characteristics, battery service life, special-purpose batteries, charging methods and charging circuits, assembled battery and general remarks and precautions. The book concludes with specification tables on the batteries and a battery glossary.

Circle (410) on Fast Fact Card

Cellular catalog includes antennas and accessories

A 28-page catalog published by Ora Electronics contains performance specifications, applications, features and photos of more than 30 models of cellular antennas, including four glass-mount models.

Additions to the line since the last catalog was published include seven replacement portable antennas for portable and transportable cellular telephones, an automatic radio shut-off switch and a "z" convertible control head mount.

Circle (411) on Fast Fact Card.

Handbook explains cellular telephone installation

The Cellular Telephone Installation Handbook by Michael Losee is a step-by-step guide that teaches the latest and most effective installation, troubleshooting and repair techniques. Antenna theory and selection are explained, along with sections on system theory, test equipment, tools, phone placement and selection. The handbook, from Quantum Publishing, includes 100 illustrations.

Circle (412) on Fast Fact Card

Booklet explains relay press mobile radio

The booklet, "Mobile Radios for Better Newspapers," explains how newspaper publishers can use two-way radio and radiopaging to improve their news-gathering operations. The report, released by the American Newspaper Publishers Association (ANPA), covers the relay press mobile radio service in detail. ANPA is the frequency coordi-

nator for the relay press mobile radio service. The booklet also explains how newspapers can make use of 800MHz communications systems. Several case studies are included.

Circle (388) on Fast Fact Card



Receive only	Freq. Ranges (MHz)	N.F. (dB)	Gain (dB)	Comp. (dBm)	Device Type	Price
P30VD, P35VD, P40VD, P45VD	30-35, 35-40, 40-45, 45-50	<1.3	15	0	DGFET	\$ 44.95
P30VDG, P35VDG, P40VDG, P45VDG	30-35, 35-40, 40-45, 45-50	<0.5	26	+12	GaAsFET	\$109.95
P150VD, P160VD, P170VD	150-160, 160-170, 170-180	<1.5	15	0	DGFET	\$ 44.95
P150VDA, P160VDA, P170VDA	150-160, 160-170, 170-180	<1.1	15	0	DGFET	\$ 56.95
P150VDG, P160VDG, P170VDG	150-160, 160-170, 170-180	<0.5	24	+12	GaAsFET	\$109.95
P450VD, P460VD	450-460, 460-470	<1.8	15	-20	Bipolar	\$ 49.95
P450VDA, P460VDA	450-460, 460-470	<1.2	16	-20	Bipolar	\$ 74.95
P450VDG, P460VDG	450-460, 460-470	<0.5	16	+12	GaAsFET	\$109.95
P800VDG, P830VDG, P860VDG	800-830, 830-860, 860-890	<0.6	19	+12	GaAsFET	\$119.95
Inline (rf switched)						
SP30VD, SP35VD, SP40VD, SP45VD	30-35, 35-40, 40-45, 45-50	<1.4	15	0	DGFET	\$ 74.95
SP30VDG, SP35VDG, SP40VDG, SP45VDG	30-35, 35-40, 40-45, 45-50	<0.55	26	+12	GaAsFET	\$139.95
SP150VD, SP160VD, SP170VD	150-160, 160-170, 170-180	<1.6	15	0	DGFET	\$ 74.95
SP150VDA, SP160VDA, SP170VDA	150-160, 160-170, 170-180	<1.2	15	0	DGFET	\$ 86.95
SP150VDG, SP160VDG, SP170VDG	150-160, 160-170, 170-180	<0.55	24	+12	GaAsFET	\$139.95
SP450VD, SP460VD	450-460, 460-470	<1.9	15	-20	Bipolar	\$ 79.95
SP450VDA, SP460VDA	450-460, 460-470	<1.3	16	-20	Bipolar	\$104.95
SP450VDG, SP460VDG	450-460, 460-470	<0.55	16	+12	GaAsFET	\$139.95

Every preamplifier is precision aligned on ARR's Hewlett Packard HP8570A/HP346A state-of-the-art noise figure meter. RX only preamplifiers are for receive applications only. Inline preamplifiers are rf switched (for use with transceivers) and handle 25 watts transmitter power. Mount inline preamplifiers between transceiver and power amplifier for high power applications. System S/N improvement 8-14 dB typical. Other amateur, commercial and special preamplifiers available in the 1-1000 MHz range. Please include \$2 shipping in U.S. and Canada. C.O.D. orders add \$2. Air mail to foreign countries add 10%. Order your ARR RX only or inline preamplifier today and start hearing like never before!

**Advanced
Receiver
Research**

Box 1242 • Burlington, CT 06013 • 203 582-9409

Circle (113) on Fast Fact Card

PACKET RADIO DONE RIGHT!

Pac-Comm offers complete wireless data communication systems using proven packet radio technology. We've used our years of packet experience to design a new commercial grade wireless modem and system multiplexer which meet tough commercial standards. These are not relabeled amateur grade products as some vendors provide!



Pac-Comm Wireless Modem

- Error-free data communication.
- Works with all land-mobile, trunked, marine, etc. radios.
- Data scrambling for privacy.
- Supports data terminal and printer simultaneously.
- Control port monitors sensors and controls external devices.
- Real time clock for time stamping data.
- Modular design for easy repair and field upgradability.
- Ruggedized industrial/military version available.
- OEM special requirements supported.

Pac-Comm Wireless Data Multiplexer

- Interfaces host computer to a multi-unit wireless data system.
- Directs data to proper remote unit and supports system manager.
- Minimizes host software modifications and user training.
- Supports optional independent electronic mail system and vehicle location system.
- Custom software may be installed to support unique requirements.

Pac-Comm has the complete range of expertise to help you build a powerful, flexible data communication system using your existing radio equipment. We won't sell you a black box, we'll help you design and build a system. Call or write for more information.

Pac-Comm Wireless Data Systems, Inc.

3652 W. Cypress St.
Tampa, FL 33607-4916

(813) 875-6417

FAX: (813) 872-8696

TELEX: 650-288-1526 MCI

Circle (114) on Fast Fact Card

Servicing radios is increasingly more challenging

Due to an overwhelming response from readers to our "How serviceable are radios?" questionnaire, the survey results will be printed in two parts.

Part 1 details serviceability statistics, including: Are radios becoming more difficult to service without sending them back to the manufacturer? and Is the cost of repair more expensive than just furnishing a user with a new unit?

Part 2 reports the most difficult challenges you face when you service a radio, as well as design trends that are expected to cause servicing problems. It also addresses: Is there a trend away from dealers servicing radios? Part 2 will appear in the September issue.

More than 76% of the readers who responded to the September 1987 "What do you think?" questionnaire survey about the serviceability of radios believe units are becoming more difficult to service without sending them back to the manufacturer. The lack of specialized test equipment, incomplete service manuals and custom parts availability are some of the reasons cited.

Technicians, overall, seem discontent with manufacturers and their support. "Less supportive technical literature is supplied," comments one reader. Other comments include: "Service manuals are not as well-written as they used to be." "Lack of clear service manuals, hints, voltage listings." "Manuals are not complete enough." "There isn't enough info (schematics, etc.) with new types of units to quickly run through the circuitry." and "Very little service data—training harder to find."

Parts availability

Besides problems with training aids and manuals, readers echo that parts are a problem "due to parts design and time to replace parts." Radios are more burdensome to repair with "more custom parts used, creating inventory problems," states one reader. "Lack of local parts supply and incomplete parts lists and schematics from manufacturers"

contribute to dealer repair frustrations, according to another response.

"Parts replacement is recommended to be done in the factory. Documentation does not provide part fault isolation or alignment," sums up one reader on the parts situation. "Parts are smaller, hard to get and hard to replace," a technician adds.

Components

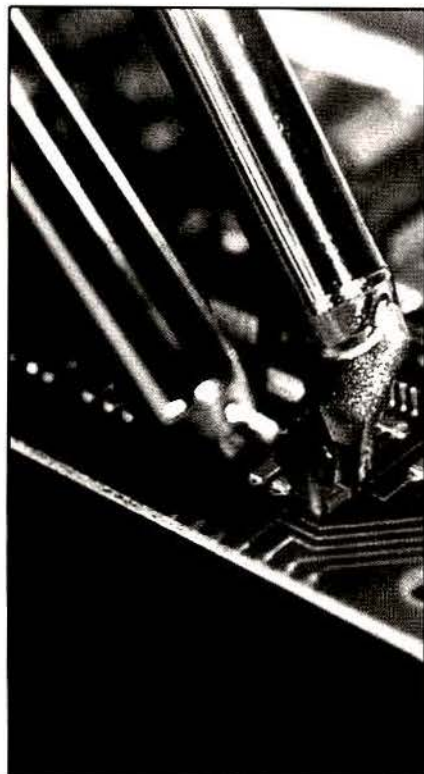
Difficulties in servicing also are attributed to components. "It is harder to replace components and troubleshoot"; "Size of components and density of many imported radios make newer radios hard to service;" and "Standard components are often unmarked or have company markings only;" concur technicians on servicing difficulties faced.

"SMD (surface-mount device) and micro-electronic LSI chips are beyond normal shop equipment."

Technicians report other problems with components: "In-house numbers on critical components are impossible to decipher." "Components are smaller and unavailable." "Many radios are only repairable by board/module replacement."

Technicians are disgruntled with the construction of equipment, saying: "Microprocessor-based radios are difficult to troubleshoot." "Higher density boards and greater use of microprocessors," make repair challenging, as well as, "high-density construction/chip and hybrid parts/multilevel PC boards/microprocessor control." "Smaller packages—tighter parts layout" also make service work demanding.

Surface-mount technology, which has enabled manufacturers to produce



Replacing components is difficult because of their small size, readers agree. Here a probe is used to hold the component in place during the reattachment process.

smaller mobiles, portables, pagers and other equipment, poses repair difficulties for technicians. "SMT (surface-mount technology), in particular, makes it extremely difficult to successfully desolder and replace components," responds a reader.

"SMD (surface-mount device) and micro-electronic LSI chips are beyond normal shop equipment," adds another reader.

Other problems with surface-mount technology include: "Use of surface-mount technology and mylar circuits add to failure rates and complicate repairs." "Surface-mount components in low-tier products are not cost-effective to repair, and packaging complicates servicing." "With the advent of micro-processor-controlled radio units, the manufacturer or his authorized service facility only has the capability (for repair)." "SMC along with interconnections are tough." "Surface-mount com-

RadioModem Eliminates Costly Wireline Data Communications.



Ritron RadioModems provide simple interfaces with most data terminal equipment such as processors, controllers and pc's via narrow band VHF/UHF FM radio. RadioModems replace expensive alternatives such as phone/wireline, fiber optics, cable or microwave. They are ideal for fixed or mobile, line or battery powered applications.


Ritron RadioModems are ready to operate, complete with transceiver and antenna. Their 1200 bps transparent asynchronous modems provide the freedom to develop the full potential of the telemetry channel. Systems are available to provide either half or full duplex radio data communications.

Check these outstanding Ritron features:

- RS-232-422 I/O
- Local Test Microphone Jack
- DB-9 Data Connector
- CTCSS/DCS Signalling
- 110 VAC/12 or 24 VDC Operation
- Complete and Self-Contained System
- American Designed and Manufactured

To learn more about the equipment that will change your way of thinking about Data Communications, call Ritron today for full details.

RITRON, INC.

505 West Carmel Drive • P.O. Box 1998 • Carmel, IN 46032 USA
PH: 317/846-1201 FAX: 317/846-4978 Made in U.S.A. 

© 1987, RITRON, INC.

Circle (115) on Fast Fact Card

*Hutton has
what it takes!*



BIRD
Electronic Corporation

ASTRON
CORPORATION

POWER SONIC

KENWOOD
TEST AND MEASURING EQUIPMENT

RF
INDUSTRIES



Cushcraft
CORPORATION

TRILECTRIC
Multiplier

SSC
SOLID-STATE COMMUNICATIONS, INC.

Repco



ARCO Solar, Inc.



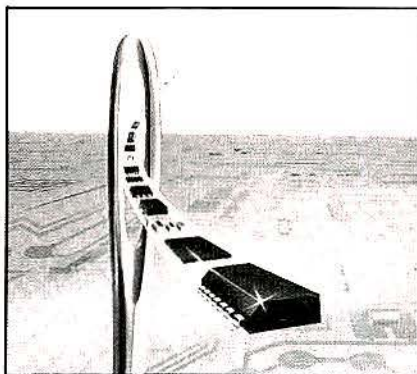
Decibel
Products,
Inc.

ALSO BYTEK, DAVID CLARK, HELPER
INSTRUMENTS, IWATSU, JABRO,
KANTRONICS, PACE/PRINT, REGENCY
ELECTRONICS, SCI, SONNENSCHN,
SPECTRUM PLANNING, STANDARD
COMMUNICATIONS & MORE.



Hutton Communications
3240 Garden Brook Drive
Dallas, Texas 75234-2309
214-484-0580 800-442-3811

Feedback



'The number of repairable modules are too small to work on without special equipment.'

ponents are difficult to change out."

Surface-mount products, as well as other equipment, also require special tools and test equipment, which contributes to servicing obstacles. "Microprocessors are hard to troubleshoot without expensive and dedicated test equipment," cites one respondent. "You have to have a large number of units out, to justify cost of new service equipment," comments another. "Can't tune some with regular test equipment. Miniaturization and four-sided boards add difficulty," adds a technician.

Other respondents agree, saying: "The number of repairable modules are too small to work on without special equipment." "Most require special adapters and equipment." "(There is) no standard programmer test equipment." "Certain radios require certain test equipment."

"With the versatility and complexity of today's radios, troubleshooting is more difficult," writes a respondent. Radios are "not unserviceable, but just harder (to repair) and time consuming," adds another reader.

Most respondents agree that it is difficult to service radios without sending them back to the manufacturer. "Each radio seems totally different. I repair the simple problems and let the factory repair the rest," summarizes one technician. Another tech comments: "I either send them back or replace full boards." "Small, multiline dealers can't afford the training cost and time required to make each technician a specialist," notes one respondent.

Contrary to above comments, some believe that radios are not difficult to

service in shop and that repair rarely warrants sending products back to the factory. According to MRT's survey, these technicians are in the minority. Their comments include: "You just have to learn new ways to do things." "Some units are easier to maintain." "Diagnostics can be done by using a computer." "All you need is the manual and test equipment." "Manufacturer reluctance to furnish data and some in-house materials are the only problems for competent technician."

Although respondents acknowledge that radio repair costs are high, 48% of them do not believe that the cost of repair is more expensive than furnishing a users with a new unit; 43% disagree, speculating that supplying new units may be more profitable in the long run; 9% did not comment.

...48% of them do not believe that the cost of repair is more expensive than furnishing users with a new unit; 43% disagree...

"In the majority of cases, the repair is still less expensive," says a dealer. "Some products are simple to repair. A good tech can fix them in less than a half hour. Which is better? \$50 labor or \$1,000 for a new unit," adds a dealer. "Most of the time, components are still cheaper than the cost of new radios," adds another respondent.

One respondent said radios are less to repair than providing new units, but added: "I'll qualify that by adding that this is assuming the technician is able to repair the radio without destroying a PC board."

Other readers concur: "Unless I'm charging too little, repairs still run $\pm 10\%$ of replacement." "Most equipment can be serviced within two hours' time. Prices have a long way to come down for this to be true. If a dealer can't repair what he sells, he should give up." "We haven't reached the throw-away ra-

Be sure to answer the "What do you think?" questionnaire on page 121 and return it so your response can be included in a future "Feedback" column.

What do you think?

How do trade shows rate with you?

1. When is your trade show?

2. How do you rate the trade show?

3. What trade show do you attend?

4. What trade show do you exhibit at?

5. What trade show do you exhibit at?

6. What trade show do you exhibit at?

7. What trade show do you exhibit at?


8. What trade show do you exhibit at?

9. What trade show do you exhibit at?

10. What trade show do you exhibit at?

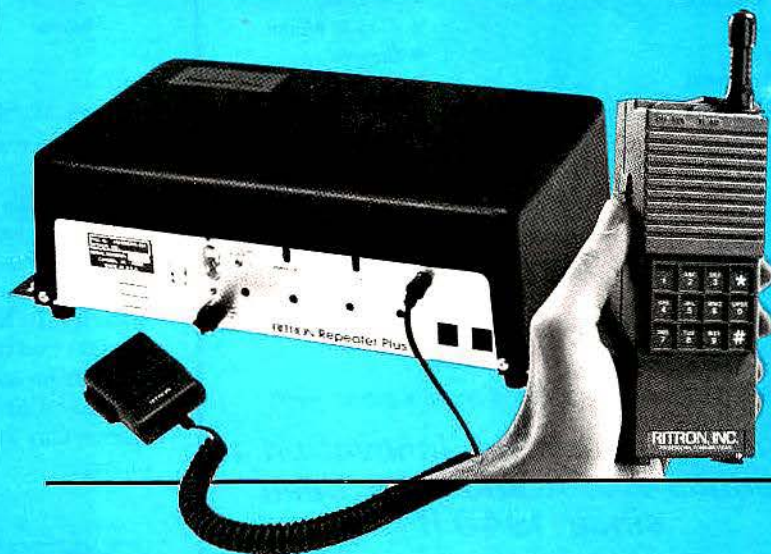
dio yet, but I wish they would consider ease of repair when they build the radio." "At this time, we are able to repair component level—most products, however, as more technological advances are made and more manufacturers market the products at reduced prices, this becomes an issue." "It approaches it (throw-away market) on some models, but most problems in newer radios are not major in nature." "Not yet, but the gap is closing fast," respondents comment.

Some respondents credit low-end products with already closing the gap: "Some radios cost as low as \$200, and repairs can easily reach this amount." "Dropping" a \$100 portable cheapie causing a two-hour repair at \$52 per hour, T&M needs no explanation. With shop rates so high, and repair parts so expensive, radios are often 'disposable' after several hours of bench time. "In most cases, to stock parts for repairs costs more than to buy new ones, plus the tech time."

"Locating intermittents is the most time-consuming and costly process. Four hours times shop dollars equals new radio!" "With the low prices of some radios, the high cost of labor to troubleshoot and repair, can easily exceed the radio's price." "Any low-end product is to be considered disposable, if damaged." "Many times this is true, i.e., radio pagers are becoming a throw-away item," respondents contend. 

RITRON

In-Plant Communications Systems Featuring the RP-200 Multi-Function Paging Interconnect



Now...even MORE control in the palm of your hand!

The Ritron In-Plant Communications System is a multi-function radiotelephone network designed to provide 2-way radio communications AND telephone capability in a complete turnkey package. The Ritron Repeater Plus Series Base Station Repeaters and the Ritron all-new PROM programmable RP-200 Multi-Function Telephone Interconnect combine to offer these exciting new features:

System Capabilities and Features


- Dial Access Paging by individual or group
- Dial-up remote capability
- Security codes to prevent unauthorized use
- Alarm input to alert users of a change in switch status
- Relay output allows On/Off control of an external device
- Touch Tone or Rotary operation
- Flash Switch Hook capability for PBX features... and more!

The Ritron Repeater Plus/RP-200 Telephone Interconnect System provides an extremely versatile, feature-packed communications system. It is ideal for use in manufacturing plants, warehouse facilities, construction sites, hotels, hospitals, shopping centers, schools... wherever people need to stay in touch.

Call Ritron today to find out more about the new Ritron In-Plant Communications System.

Call 1-800-USA-1-USA.

RITRON, INC.

505 West Carmel Drive • P.O. BOX 1998 • Carmel, IN 46032
TL: 317-846-1201 FAX: 317-846-4978 **Made in USA** 
©1988 Ritron, Inc.

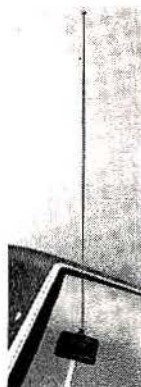
Circle (117) on Fast Fact Card

Look at our **MOBILE MARK**TM "ON WINDOW" Line

PATENTED

VHF (140-175)

- No Hole
- Easy to Mount
- Rugged
- Superior Performance
- Radiator Snaps On and Off
- Competitively Priced



UHF (420-520)

- 3 db gain
- No Hole
- Easy to Mount
- Rugged
- Superior Performance
- Radiator Snaps On and Off
- Competitively Priced

220 MHz Available Now!

MOBILE MARK, INC.
COMMUNICATIONS ANTENNAS

3900-B River Road • Schiller Park, IL 60176 • 312-671-6690

*brings imagination and innovation to
antennas and has been
since 1948 !!*

Circle (118) on Fast Fact Card

A Bright Idea!



NEVER! A VHF antenna that looks like a normal incandescent light bulb. A cellular antenna (and it's that good). From STICO, the best ideas are disguised.

STICO[®]
DISGUISED ANTENNAS

36 LETCHWORTH STREET / BUFFALO, NEW YORK 14213 / (716) 881-3287

CERTIFIED W.B.E.

Circle (119) on Fast Fact Card

P eople



Stupka



Patton



Kline



Small

Jerry W. Stupka joins Antenna Specialists, Cleveland, as eastern regional sales manager.

Promotions at Maxon, Kansas City, MO: **David Patton**, western regional sales manager, advances to national sales manager; **Roslyn Kline**, tele/sales order service manager, takes Patton's place as western regional sales manager. **Charles J. Kraft**, OEM product engineer, to manager, product marketing. **Mark S. Cheny**, paging project engineer, to product development manager.

C.L. "Cal" Small, supervisor of communications for Kansas City Power and Light, joins Maxon as data products manager.



Baker



Clark



Ritchie



Haygood

C.E. Baker Jr., president of U S West Paging, joins Arch Communications, Boston, in the same capacity.

John Clark, a member of Decibel Products' Dallas marketing engineering group, transfers to the company's field systems engineering office in Chicago as a field systems engineer.

Annette Ritchie, account supervisor, MW Advertising, joins Magnavox Marine and Survey Systems, Torrance, CA, as marketing communications manager.

Dale R. Haygood advances to vice president of manufacturing at Lightning Master, Brooksville, FL.

Stephen J. Katz, sales representative, commercial two-way radio sales division, Motorola Communications and Electronics, Overland Park, KS, joins Kustom Electronics, Lenexa, KS, as account manager, communications division.

William D. Crowl joins Selectone, Hayward, CA, as sales engineer. **John Sutherland** advances from senior applications engineer to manufacturing engineer.



August

8-12—APCO 54th Annual National Conference, Little Rock Convention Center, Little Rock, AR. Contact: 800-824-1850.

27-31—International Association of Fire Chiefs Annual Meeting, Washington Convention Center, Washington, DC. Contact: 202-833-3420.

September

14-16—Land Mobile Expo/East, Georgia World Congress Center, Atlanta. Contact: 303-220-0600.

16—NABER Technician Certification Exam, Expo/East, Atlanta. Contact: 800-759-0300.

24—NABER Technician Certification Exam, various locations. Contact: 800-759-0300.

28-Oct. 1—Telocator Network of America 40th Annual Convention and Exposition, Rivergate Convention Center, New Orleans. Contact: 202-467-4770.

October

3-4—American SMR Network Association Meeting, Alameda Plaza Hotel, Kansas City, MO. Contact: 202-331-7773.

9-12—National Association of Business and Educational Radio Mid-Year Meeting, Radisson Mark Hotel, Alexandria, VA. Contact: 800-759-0300.

15-20—International Association of Police Chiefs Annual Meeting, Portland Coliseum, Portland, OR. Contact: 301-948-0922.

19-22—SIRSA Annual Meeting, Buena Vista Hotel, Orlando, FL. Contact: 703-528-5115.

November

19—NABER Technician Certification Exam, various locations. Contact: 800-759-0300.

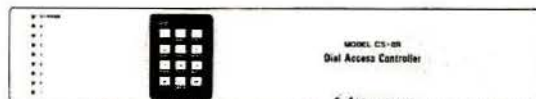
19—Radio Club of America Annual Meeting and Awards Banquet, New York Athletic Club, New York. Contact: 201-246-7271.

19-21—Communications Marketing Association Conference, California location TBA. Contact: 312-593-8360.

January

30-31, 1989—American SMR Network Association Expo and Winter Membership Meeting, Lake Buena Vista Palace, Orlando, FL. Contact: 202-331-7773.

TOUCH TONE CONTROL



MODEL CS-8 DIAL ACCESS CONTROLLER \$449

Use any touch phone and ordinary dial-up lines to operate eight separate remote site Form C relays and also check the states of up to eight external inputs. Audible telemetry acknowledges commands and indicates the on/off condition of each external input.

- Four selectable modes
 1. Latched
 2. Momentary
 3. 1 of 4 exclusive OR latched
 4. 1 of 8 exclusive OR latched
- User programmable access code
- Master reset function
- Auto answer on 1-8 ring
- LED status indicators
- +12 VDC powered
- Rack and wall mount versions

Front panel touchpad optional



MODEL CS-100 DTMF CONTROLLER \$499

The CS-100 puts sixteen remotely commandable relay outputs at your control when connected to your remote radio or microwave link.

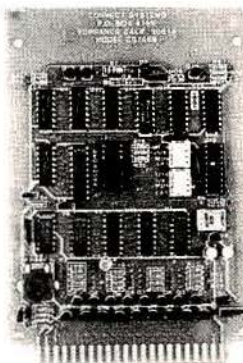
- Four selectable modes
 1. Latched
 2. Momentary
 3. 1 of 8 exclusive OR latched
 4. 1 of 16 exclusive OR latched
- User programmable access code
- +12 VDC powered
- 1MV to 3V DTMF input
- Barrier strip terminals
- Card cage construction

Front panel touchpad optional

MODEL CS-1688 TOUCHTONE CONTROL BOARD \$189

This is the same powerful control board as used in the CS-100 panel.

- Programmable access code
- On board pre-amp
- Four selectable modes
 1. Latched
 2. Momentary
 3. 1 of 8 exclusive OR latched
 4. 1 of 16 exclusive OR latched
- Open collector outputs
- Std 4.5" x 6.5" card size
- 22 pin gold plated edge connector
- Mating connector supplied
- 10-28 VDC operation



MODEL CS-16 TOUCHTONE CONTROL BOARD \$149

Sixteen latched open collector outputs. Physically similar to the CS-1688.

Please inquire about our superb line of dial access paging and radio telephone interconnect products.



CONNECT SYSTEMS INC.
23731 Madison St.
Torrance CA 90505
Phone (213) 373-6803



TELOCATOR
40th ANNUAL
CONVENTION & EXPOSITION
New Orleans
SEPTEMBER 28-OCTOBER 1

Come celebrate "40 Years On the Move" with Telocator, the oldest and most authoritative voice of the mobile communications industry.

Keynote speaker John Naisbitt, author of *Megatrends*, will set the forward-looking theme. Educational programming built around five tracks—Financial, Marketing, Legal, Technical and "Issues of the '90s"—will provide guidelines for success today and in the future.

As always, exhibitors representing the latest product lines for RCCs, cellular and conventional mobile operators, and affiliated industries will be on hand—up to 150 anticipated.

No city in America is better suited to hosting a gala anniversary celebration than New Orleans, and Telocator plans to capitalize on the Crescent City's charm with special events to make your visit memorable.

Want more information? Call 1-800-422-4862.

GE PORTABLE SERVICE

- FAST TURN
- WARRANTY
- \$32.00 hr./2 hr. MAX
- PARTS GE LIST
- RETURN UPS PAID



Smith Communications Service
2121 PARRISH AVE.
OWENSBORO, KY 42301
502-663-0936

BILL SMITH

FREELAND COMMUNICATIONS CONSULTANTS

ENGINEERING SPECIALISTS IN TWO-WAY RADIO

401 EDITH
BATESBURG, SC 29006
(803) 532-6707
ANDREW F. FREELAND

J. NED HINES

CONSULTING ENGINEER
Design, Fabrication, & Test of
Custom Prototype Antennas

22 KNOLLWOOD ROAD
MORRISTOWN, NJ 07960
(201) 539-6976

Design
Construction & Service
On Specialized Micro-Systems



INTERNATIONAL MICROSYSTEMS INCORPORATED

310 E. Polk
West Memphis, AR 72301
501-735-7251

TAC-5e & TAC-5 MANAGER
The ULTIMATE Interconnect
Equipment for the GE SMR

ADCOMM ENGINEERING COMPANY

Communications & Electronics Engineers

- Mobile Telephone & Paging
- Microwave Radio
- Fiber Optics
- Special Systems

(206) 821-8827 14631 • 128th Avenue N.E.
Kirkland, WA 98033



COMMUNICATIONS TECHNOLOGY ASSOC., INC.
P.O. Box 4579 •
Lynchburg, Virginia 24502
(804) 239-3100

"Specializing in Public Safety and Cellular"

Mobile
Trunking
AVL/AVM
Cellular
Microwave
Fiber
Data

Design
Analysis
Specification
Surveys
Installation
Documentation
Support

Judy Hockemeyer
Sales Representative

3db Elevated Feed



Base Station Mobile & Portable Antennas

1-800-323-9122

2495 Pan Am Blvd.
Elk Grove, IL 60007

WILLIAM ROBERTS & ASSOCIATES

TELECOMMUNICATIONS SYSTEMS DESIGNERS & BUILDERS

BILL ROBERTS
PRESIDENT

1358 Oakland Road, Ste. 110
San Jose, California 95112 (408) 298-0510

1152 St. George Avenue
Avenel, NJ 07001
201-636-6970



Mobile & Microwave Radio
Systems Consultants



Cellular Depot Inc.

(215) 364-7880 • (800) 421-9175 • FAX (215) 364-7899

Alpine	Code-Alarm	Mobile Mark	Panasonic
Arizona Specialist	Fujitsu	Mobira	Sharp
Audiovox	General Electric	Modulox	Sony
Blaupunkt	Hirschman	Motorola	Tandy
Bel-Tronics	Jensen	NEC	Tellular
Br-TEK	K-40	NovAtel	Toshiba
Casco	Maciber	OKI	Uniden
Cobra	Mitsubishi	ORA	Whistler

Master Distributor Mobile & Portable Cellular Phones
Dealer Inquiries Invited



Intrafamily Communications Co.

"National Communications Site Directory"
Nationwide sites available for leasing - Free copy
106 Cold Spring Road - Freehold, New Jersey
(201) 462-5964

Consultation Services

Lightning Protection • Power-Line Conditioning
Grounding • Electromagnetic Compatibility
Over 40 years experience, work guaranteed

Ray Carpenter
Chairman and CEO

Lightning Eliminators and Consultants, Inc.
13007 Lakeland Rd. Santa Fe Springs, CA 90670
(213) 946-6886 • FAX (213) 941-2738 • Telex 379 1984 LEC

JAMES H. BAKER
Executive Vice President

3025 Hayard Street
Post Office Box 5446
Eugene, Oregon 97405
Phone 503/485-8441



FOREST INDUSTRIES
TELECOMMUNICATIONS

The Forest Industry's Voice before the Federal Communications Commission

Stuart Meyer
LAND MOBILE CONSULTANT

2417 NEWTON ST
VIENNA, VA 22180
(703) 281-3806

FCC CALL
8883540

Communication Equipment Specialists, Inc.



KEITH L. LEWIS

816/524-8242
212 N. Main, Box 1700
Lee's Summit, MO 64063



RAYMOND C. TROTT
CONSULTING ENGINEERS, INC.
1425 GREENWAY DRIVE, SUITE 350
IRVING, TEXAS 75038
214/580-1911

RAYMOND C. TROTT, P.E.
PRESIDENT

LAND MOBILE / MICROWAVE COMMUNICATIONS SYSTEMS

FREDERICK G. GRIFFIN, P.E.
PRESIDENT



FREDERICK G. GRIFFIN, P.C.

A Professional Communications Engineering Firm

3229 WATERLICK ROAD
LYNCHBURG, VA 24502

804 237 2044



OMNICOM, Inc.
TELECOMMUNICATIONS ENGINEERING

GENE A. BUZZI
PRESIDENT

WOODCREST OFFICE PARK
370 JONHAYNDRON RD. SUITE E 204
TALLAHASSEE, FL 32303
PHONE (904) 386-3190

YOUR CARD HERE
reaches 63,661 prospects
for as low as \$60 per
insertion.
Call 303/762-1249

HERB SACHS, CONSULTING
Specialist in Public Safety Communications

P.O. Box 729
Bowie, MD 20715
301-464-4268

R. James Evans
COMMUNICATIONS CONSULTANT

MEMBER IEEE-APCO
(517) 351-3252

2803 SOUTHWOOD DRIVE
EAST LANSING, MI 48023

C lassified

Advertising rates in **Mobile Radio Technology's** Classified Section are \$54.00 per column inch, per insertion, with frequency discounts available. There is a one inch minimum.

Ads larger than one inch are sized in 1/4-inch increments and billed accordingly, as determined by total size of the ad, including ruled borders and rounded up to the nearest 1/4-inch.

Blind box ads (replies sent to MRT for forwarding) and Fast Fact reader service numbers are available at \$25.00 per service, per insertion, to cover processing and handling costs.

Optional color, determined by MRT on an issue-by-issue basis, is available at \$150 per insertion.

A prepayment discount of 5% is available for all 6x or larger frequency classified advertisers who prepay their full 12 month schedule.

No agency discounts are allowed for classified advertising.

Contact Diane Hite at (303) 762-1249 in Denver to place your classified ad, or send your classified advertising materials and order to **Mobile Radio Technology**, Advertising Department, P.O. Box 12901, Overland Park, KS 66212.

Help wanted

Electronic Technician

Positions available for experienced electronic technicians possessing a general class FCC license and/or NABER certificate. Applicants must have a minimum of 5 years on the job experience in testing and analyzing, troubleshooting of mobiles, portables, and fixed stations. We offer an excellent salary and outstanding benefit program. Candidates are invited to send their resume stating history of experience and salary requirements to: **MOTOROLA INC., Charleston Service Center, 329 6th Ave., South Charleston, WV 25303. EOE/AA.**



Communications and Electronics Inc.

Circle (417) on Fast Fact Card

LEAD TECHNICIAN

Quigley Communications Inc., a Motorola MSS in Southern, CA, seeks lead technician to perform service on mountain top repeaters, including SMRs, simulcast paging systems using Modax Plus terminals and PURC transmitters, etc. Position requires 4 years of 2-way experience, and an FCC General Class Radio/Telephone license. Send resume with salary requirements to:

Quigley Communications
4506 Federal Blvd., Ste. A
San Diego, CA 92102
Attn: Ronald Patterson

Circle (418) on Fast Fact Card

MANAGEMENT

American Paging Inc. is one of the fastest growing paging companies in the United States. We are currently seeking general managers for city operations. Successful candidates will have had prior sales, collections and profit and loss responsibilities. We offer:

- excellent salary
- bonus program
- company paid benefits program
- car allowance

Please send resume with salary requirements to:

Mr. Austin Parchman
Director of Operations
American Paging Inc.
2780 Snelling Ave. N., Ste. 304
St. Paul, MN 55113

Circle (419) on Fast Fact Card

ENGINEERS

TRANSTRACK INC. a high-tech company, is pioneering a nationwide, two-way communication system for mobile units utilizing an innovative combination of microprocessor based radios and land lines.

Senior RF Design

5+ years experience in RF engineering, to design a 300-watt, high-speed VHF meteor burst data radio. Proficiency in RF modem design, receivers, antennas and power amps.

RF Design

Engineer with an electronics background, knowledgeable in RF. Excellent opportunity to apply your RF knowledge in system design and development.

Electronic Design

Experienced engineer in electronic design, signal processing, or integration of microprocessor-based control.

Our goal is to attract and retain bright, dedicated individuals for long-term career development in a creative environment. This is an opportunity for good engineers to bring a system from concept to production.

TRANSTRACK INC. is an equal opportunity employer with an attractive benefits package. Our compensation program will be based on experience plus performance bonuses. For consideration, send resume with salary history/requirements to:



13 Marconi
Lane
Marion, MA
02738
Personnel
Dept.
(508)
748-2974

Circle (420) on Fast Fact Card

TECHNICIAN NEEDED

Five years experience required on Motorola and GE two-way. GE trunking helpful. Cellular knowledge a plus. Salary commensurate with ability. Call or send your resume to:

Communication Systems, Inc.
5521 N.W. 78th Ave.
Miami, FL 33166
(305) 592-8536

Circle (421) on Fast Fact Card

** NEEDED IMMEDIATELY **

Two-Way Radio Technician w/Experience in the E.F. Johnson Equipment and NABER Certification. Top Pay and Benefits. Contact: Jack Bailey, Jr., Eastern Radio of Charlotte, NC. 704-332-9199 or 704-534-1000.

Circle (422) on Fast Fact Card

EXPERIENCED TECHNICIANS!

Field/shop service technicians needed for 40-year-old, 5-site SMR and shared repeater service in Odessa, TX. Dependable, hard-working applicants with knowledge of GMarc and other GE products preferred. Profit sharing/excellent salary. Send resume to: Mike Graham, Commercial Radio Service, Inc., P.O. Box 912, Odessa, TX 79760, (915) 333-2737.

Circle (423) on Fast Fact Card

Equipment for sale

MOTOROLA CENTRACOM I & II

Console components
BOUGHT & SOLD

G.E. Voters \$995
Mot. 12W APCORS \$1995

Telecommunications Engineering Associates
409 Wildwood Dr.
So. San Fran., CA 94080
Ph: (415) 871-4200

Circle (424) on Fast Fact Card

Equipment for sale

MOTOROLA RADIOS

BUY & SELL

PORTABLES •
PAGERS • REPEATERS
MOBILES • BASES

- Selling **MOTOROLA** exclusively for 15 YEARS!
- We don't sell junk: if you buy from us ... **IT WORKS!**

- All equipment totally reconditioned
- Every radio bench tested **TWICE!**
- P.L. Reeds **free** with order, if stocked.
- We sell to dealers at **WHOLESALE**.
- Quality Equipment ... **NO SURPRISES!**



CALIFORNIA RADIO®

16943 - 6200 ROAD, MONTROSE, COLORADO 81401

Toll Free order line: 800-231-0103 Customer Service: (303) 249-1414

FAX LINE — 1-303-249-4334 WORLDWIDE TELEX — 510-100-5408

Circle (425) on Fast Fact Card

USED UHF EQUIPMENT

- 2 Aerotron MPAC 90-watt base station repeaters with 18 card tone panels. One works, one needs transmitter and receiver repair.
- 1 TX/RX Systems cavity filter with four 4-inch cavities on standing rack, with associated duplexers and expandable multicouplers.

All equipment is for 450-512 MHz band. Has been kept warm, dry and in good condition. All technical manuals with same. Inquiries to:

David M. Chasey
Facilities Manager
OCEANSIDE, INC.
217 Thornton Dr.
Hyannis, MA 02601
(508) 771-3110
In MA: 1-800-354-8700

Circle (427) on Fast Fact Card

RADIO BARN

- **REGENCY Radios**
- **REGENCY PLUS Radios**
- **ANTENNA SPECIALISTS**
- **ASTRON Power Supplies**
- **AEA Base Antennas**
- **GAMBER-JOHNSON Mounts**

**We also service
Regency Radios**

Call:

1-800-325-8646
KS 913-336-6357

Circle (428) on Fast Fact Card

SERVICE MONITOR

Ailtech-Gertsch Model FM10 CS with ODM-1, FIM-4, RFM-10E. \$2,500 or best offer.

Call: (301) 939-0332

Circle (430) on Fast Fact Card

FOR SALE:

23 GHz GE Gemlink TI Microwave. Approx. 4 years old. Make us your best offer. Contact: W.A. Watkins at Bald Head Island, N.C. (919) 457-5000.

Circle (431) on Fast Fact Card

B-D CRYSTAL

- Communications
- Pagers—Recrystallized/Repaired
- Channel Elements
 - Recrystallized
 - Compensated
 - Complete elements

**48 HR. SERVICE
AVAILABLE**

(513) 522-3300

FAX (513) 522-2737

1727 W. Galbraith Rd.
Cincinnati, OH 45239

Precision Quality Quartz Crystals
Made To Your Specifications

Circle (426) on Fast Fact Card

COMPLETE CHANNEL ELEMENTS ON YOUR FREQUENCY FOR

\$25 - \$35!!!

ORDERS ONLY:

1-800-237-6519

INQUIRIES AND IN LA:

504-361-5525

- ☐ Motrac; Micor; Mocom; Mitrek; Etc.
- ☐ Guaranteed to Meet or Exceed OEM Specs.
- ☐ Any desired Frequency available for fast delivery.
- ☐ Lifetime Warranty on Crystals.
- ☐ We give Trade-in credit for your Old Channel Elements.

Try us first. We always have your frequency available.

NKX

2320 South Friendship Drive
Harvey, LA 70058

Circle (429) on Fast Fact Card

WE OFFER THE HIGHEST BID for your clean, used Motorola FM two-way radios, portables and mobile radios. We also sell reconditioned Motorola equipment at fair market value.

Call Jeff at (405) 256-7130
or (800) 541-0475

SOUTHERN PLAINS RECON
(Formerly MATRIX)

Circle (432) on Fast Fact Card

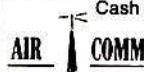
Equipment for sale

USED 2-WAY RADIOS

Call Sid Cohen
at AIR COMM—Phoenix, AZ
(602) 254-6534

30%-70% savings on Motorola, GE, EFJ mobiles, base stations, portables, pagers, repeaters—primarily solid state—all frequency bands. Also, accessory items: Motorola "Systems 90" control heads. PL and paging reads, channel elements.

Cash quotations made for purchase of above equipment.
1824 E. McDowell
Phoenix, AZ 85006



Circle (433) on Fast Fact Card

NEW 2GHz MICROWAVE ANTENNAS FOR SALE

Still in shipping crates. Selling below cost.
Call and ask for Joe:

(501) 646-6445

Circle (434) on Fast Fact Card

SINGER — EATON MONITOR REPAIR

Including Certification —
2- to 3-week turnaround.

We BUY, SELL and TRADE
used monitors.

Need modules for FM-10CS.
Call:

AEL

Singer Representatives
12345 Bowling Green Rd.
Auburn, Kentucky 42206
1-502-542-6000

Circle (435) on Fast Fact Card

WE BUY AND SELL USED MOTOROLA AND GE FM TWO-WAY RADIOS

- 440 GE Portables, 490-512 MHz, PE55KFWFPX, 8 Freq.
- 18 MITREK, 152 MHz, T43JJA3000
- 2 MAXAR 80, 152 MHz, D33TSA1000
- 4 MITREK, 37 MHz, T51JJA2000
- 9 Local desk sets, T1903
- 17 MICOR, 152 MHz, T83RTA4903
- 1 MICOR Base, 49MHz, C71RCB3405

SCHAEFER RADIO CO.
1301 Grant • P.O. Box 395
Denver, Iowa 50822 319/984-6115

Circle (436) on Fast Fact Card

MOTOROLA TRUNKING I

Spare boards and parts for
Central Controller

(213) 850-0250

Circle (437) on Fast Fact Card

THE ANTENNA FARM®

11500 West 90th ■ Overland Park, Kansas 66214
Kansas Customers Call COLLECT 913-492-6212

THE #1 COMMUNICATIONS SUPPLIERS IN THE HEART OF AMERICA

CHOOSE FROM OUR COMPLETE LINE INVENTORY OF:

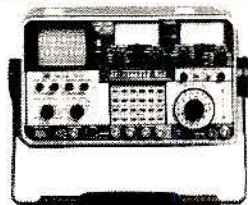
ASTRON POWER SUPPLIES
ANTENNA SPECIALISTS
ANDREW® CABLE
BIRD ELECTRONICS
CENTURION INT.
CABLEWAVE SYSTEMS
CABLE TIE'S
RF INDUSTRIES

CALL TOLL FREE
1-800-255-6222

CUSHCRAFT "PROLINE"
DECIBEL PRODUCTS
HELPER INSTRUMENTS
MAXRAD
PIPO
SIGNALS
SELECTONE
HUSTLER ANTENNAS



Circle (438) on Fast Fact Card



test equipment



Communications
Associates Inc.

(800) 435-9313

In Illinois (800) 892-1611

Circle (439) on Fast Fact Card

DO YOU FEEL LUCKY?

CAN YOU AFFORD DOWN TIME?

Inadequate Grounding and Lightning Protection can result in Down Time and other costly losses—Most importantly possible loss of customers.
YOU CAN GET LUCKY and also reduce Down Time when you CALL HARGER.

LIGHTNING PROTECTION AND GROUNDING EQUIPMENT BY:



HARGER

Lightning Protection, Inc.
551 North Avenue
Libertyville, IL 60048

Phone (312) 362-4848
Fax No. (312) 362-3519

Circle (440) on Fast Fact Card

FOR SALE:

100-watt 42-50 Mitreks.
 Ferrite TX combiners, RJ and Sinclair, VHF and UHF 250-watt.
 Motorola 900 MHz receivers.
 GE EP 39 and receiver.
 Many outdoor cabinets and Micor cabinets.
 Motorola test set, console stations.
 VHF Exec. II's.
 Motorola Syntor X² trunked radios, receiver combiners UHF.
 GE voting cards.
 T1600 tone remotes.
 UHF Maxar 80's.
 Deskcom remotes.

Call:

First Class Communications
 1705 Peters Rd.
 Irving, TX 75061
 (214) 438-1215

Circle (441) on Fast Fact Card

CALL NOW**WALKIE TALKIE PACKAGE SALE**

at less than factory direct pricing!

Ritron Jobcoms
Regency UC-102

VHF • VHF/VOX • UHF • PORTABLES

Just a phone call away!

800-821-0107
 (in California)

800-325-4833
 (National)

**ARGUS** ELECTRONICS, INC.

23210 Bernhardt St.
 Hayward, CA 94545
 (415) 887-1440, FAX: 415-887-7595

Orders placed by 6 p.m. EDT
 Will be Shipped Same Day
 Next Day Delivery Available in U.S.

Circle (442) on Fast Fact Card

Dual Band

VHF/UHF Yaesu Handheld • Shipping in August
 To order call * 1-800-444-7077

Hi-Com Systems Inc., P.O. Box 1185, Kennedale, TX 76060

Circle (443) on Fast Fact Card

RF CONNECTORS

UHF • N • BNC • SMA • TNC
 AND ADAPTERS

MANUFACTURERS

AMPHENOL-DELTA
 KINGS-RF INDUSTRIES

Also: Coax cable & heat shrink tubing



CROWN
ELECTRONICS INC.

3129 N. Highway 67, Suite H
 Mesquite, Texas 75150
 (214) 681-7882
 (800) 225-3429

Circle (444) on Fast Fact Card

CRYSTALS

FOR ALL RADIOS

- ☐ CHANNEL ELEMENTS ☐ BATTERIES
 Recrystallized & Compensated For Portables & Pagers
☐ MONOLITHIC CRYSTAL FILTERS

EMERGENCY SERVICE

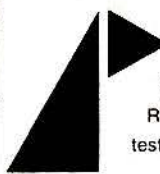
FOR CRYSTALS 24 Hours / 72 Hours / 1 Week
 Normal Delivery 3 Weeks

Competitive Pricing!!!**800-333-9825**

CAL CRYSTAL LAB, INC.

1142 No. Gilbert, Anaheim, CA 92801 FAX 714-491-9825
 HIGH QUALITY, TIGHT TOLERANCE CRYSTALS

Circle (445) on Fast Fact Card

PARKINSON ELECTRONICS CO.**Radio Mod's to GE Mobiles and Others**

TM

Expand C-Series HORN HONK • Make REPEATERS from GE mobiles and others • Switch-Off mobiles with POWER-DOWN timer, 1-31 hrs. • Change AREA on GE MARC control stations REMOTELY • Expand Classic I to 8-AREAS • Rugged-ize bench-test cable • Repackage V-E interconnect in SMALL rack height.



Call for catalog or tech ideas (800) 332-7003 X 308

Circle (446) on Fast Fact Card

FOR SALE:

22 GE low band mobile units and 1 GE base station. Asking \$12,000.

Call:

Decker Construction Co.
 (614) 488-7958.

Circle (447) on Fast Fact Card

This Month's Specials:

GE PE Portables, Model PE56RAS66, 2-watt, 150-170 range, no CG. As is: \$50.00
 GE Exec. II, high-band exciter boards, 19D424395 G1/G2/G3. \$25.00
 Also many other boards available. Complete Catalog Available



Call (201) 489-9000
GREGORY ELECTRONICS CORP.

249 Route 48, Saddle Brook, N.J. 07662

Circle (448) on Fast Fact Card

SPECTRUM ANALYZER

0.1 to 1500 MHz HP 182T Mainframe, 8558B analyzer, \$6,000.

Call: Mary Jane Bryan
 (213) 322-3666

Circle (449) on Fast Fact Card



lassified

Equipment for sale

TONE SIGNALLING

Programable CTCSS ENCODERS/DECODERS
Two-Tone DECODERS
DTMF ENCODERS and DECODERS
Complete Catalog Available
(312) 668-4600 FAX (312) 668-5216
trans com inc.
470 RANDY RD • CAROL STREAM, ILLINOIS 60187



Circle (450) on Fast Fact Card

USED PAGERS

Motorola and NEC. Reconditioned on
your channel w/warranty or as is.
GE Exec. control stations, mobiles.



(303) 337-4811
FAX (303) 337-3084

Circle (452) on Fast Fact Card

PARTS

ACCESSORIES &
SERVICE MANUALS FOR:



RAB PARTS INC.
1 West Pike St.
Canonsburg, PA 15317
412-873-4600

Circle (451) on Fast Fact Card

TACTEC TACTEL RCA



**MOTOROLA - GE - KING
UNIDEN - STANDARD - KENWOOD**
LIGHTWEIGHT • MUFF • VOX

800/346-6442

**HEADSETS
FOR
RADIOS**

CA 415/943-6442

Circle (453) on Fast Fact Card



**FM/AM-1200S with
Tracking Generator**
in stock for same-day shipment

primus

ELECTRONICS CORPORATION

In Illinois, 800-892-1413 • Nationwide, 800-435-1636

Circle (454) on Fast Fact Card

Equipment wanted

**IMTS or RCC CAR
PHONES WANTED**

Top Prices Paid!
Contact: **MIKE WINKLER**
17235 Sierra Highway
Canyon Country, CA 91351
(805) 251-2244
or (800) 423-2565 outside CA

Circle (455) on Fast Fact Card

Clean Equipment, Low Price

- | | |
|--|---|
| 1 MICOR Repeater 250W UHF \$2,995 | 5 GE MASTR II VHF 100W BF CG \$395 |
| 1 MICOR Repeater 250W VHF \$2,995 | 2 GE MASTR IIE Dual band 100W 42-50 MHz & VHF w/s 8F Scan \$395 |
| 1 MICOR Repeater 30-36 MHz Base PL, DC \$1,495 | 7 GE MVP VHF Base 25W CG \$295 |
| 1 MICOR VHF Base 100W PL, DC \$1,495 | 1 GE MASTR PRO Base UHF 70W \$495 |
| 1 MOCOM 70 Base VHF 100W PL/DPL \$895 | 5 GE EXII 30-36 MHz 50W NB \$225 |
| 25 MICOR VHF 110W 4F Scan wide spaced TX & Rec \$395 | 10 GE MASTR II VHF 60W 2F N/A \$150 |
| 25 MICOR VHF 110W PL 4F Scan \$395 | 10 GE MASTR II 42-50 MHz 100W CG \$295 |
| 1 J71LP8 Base 150W 30-36 MHz PL \$495 | 5 GE EXII VHF 60W CS \$195, CG \$250 |
| 5 MICOR Mobile 36-42 MHz, 100W PL \$495 | 10 GE Imperial UHF Makes all transistor 30W CG repeater in one hour \$100 |
| 10 MICOR VHF 110W DPL 4F \$495 | 3 GE MASTR II UHF 40W CG \$350 |
| 10 MICOR VHF 110W PL 4F N/A \$150 | 20 GE MSTR PRO VHF 100W N/A \$50 |
| 5 MICOR UHF 75W 12F \$395 | 6 GE Royal Exec 40-50 MHz 60W CG NB \$150 |
| 1 MOCOM 70 VHF 100W PL/DPL \$395 | 4 GE Royal VHF 35W CS \$150 |
| 5 MAXAR UHF 25W PL/DPL \$250 | 1 GE YC56RFAB66A VHF RCC Phone \$250 |
| 4 MOCOM 70 VHF 25W 4F \$150 | 1 GE YC55RPLE88A UHF RCC Phone \$250 |
| 2 PULSAR II UHF I.M.T.S. Bell N/A \$250 | 10 MITREK UHF 100W 4F PL/DPL \$595 |
| 4 MAXAR80 490-512 MHz, 25W 4F DPL \$195 | 1 MITREK Base UHF 50W 1F PL/DPL \$695 |
| 15 GE MVP 36-42 MHz 25W CS \$125 | |
| 1 GE EXII VHF 100W 4F CG \$350 | |

Sold with Accessories Including Reeds & Crystals, Guaranteed Working
We buy/sell Used Motorola & GE Mobiles & Bases — Trade Also.
We do not sell pagers, portables or parts, reeds or Channel Elements

BARNETT ELECTRONICS

8718 Wilhite Lane • N. Little Rock, AR 72116

(Orders & Bids Only) 800-423-3858 • (Others) 501-835-7066



Bob Barnett

Circle (457) on Fast Fact Card

**Used And Re-Conditioned Cellular Car
Phones Wanted.** Contact: Kathy or Mo.
Cellular Success Systems, a division of
TransAtlantic Auto Imports, Inc.
(216) 831-9000

Circle (456) on Fast Fact Card

**So much
exposure. So
little money.**

Target 63,661 product and service buyers for only \$54. Call Diane at MRT Classified, (303)762-1249.

Tower space



ANTENNA SITE LOCATOR

Nationwide, we find your site, quickly and economically.

American Site Network

122 Second Avenue / New York, NY 10003

Contact: Drunell Gross (212) 477-4777

Circle (458) on Fast Fact Card

Tower Space Available

Bucks County, PA — Suburban Phila.

550' Self Supporting Tower — Multicoupled for 450, 500, 800 & 900 MHz — Intermod Free — Stand-by AC Power — Excellent Facilities.

Contact Bill Ferguson
Beam Corporation
215-639-9211

Circle (459) on Fast Fact Card

DRYAN COMMUNICATIONS

Near Colorado Springs on
Cheyenne Mountain
Serving Southeastern Colorado
Excellent Facilities — 150' Rohn 65

7235 Baker Road
Colorado Springs, Colorado 80908
719-495-2529 / Pager 719-630-9991

Circle (460) on Fast Fact Card

Computer products

IMSITM

Complete site development/maintenance software for IBM PC, XT, AT, PS-2.

Creates/maintains complete site records and docs. Reports printed include complete graphical site representation; includes customer data base and more.

CYBORG TRACKER™ Included.

Complete expert system interference/intermodulation analysis and tracking (200 x 200). Quick reference cards, tutor. For consulting engineers, systems managers, service managers. Until Nov. 15, 1988—\$250. After Nov. 15, 1988—\$475.

CyberSym, P.O. Box 227, Blacksburg, VA 24063. (703) 268-5400.

Circle (461) on Fast Fact Card

FIRST REPUBLICBANK PLAZA DALLAS MAIN CENTER

Dallas' Tallest Tower

Dallas, TX Tallest Tower
The 74 Story First RepublicBank Plaza is now available for your Communications Facility.

- 900 MHz SMR Ready
- 900 MHz PCP/RCC
- 800 MHz Systems
- 150-450 MHz Systems

This one-of-a-kind roof top facility is dedicated to the Land Mobile Industry and has been featured in several magazine articles.

CONTACT:
JIMMY CHILES
(214) 761-6277

Circle (462) on Fast Fact Card

TOWER SPACE

Prime Sites in Washington, D.C.
Baltimore, Maryland
Salisbury, Maryland
Two-way radio and microwave
Maryland Communications, Inc.
(301) 561-8255

Circle (463) on Fast Fact Card

IBM INTERMOD SOFTWARE \$150 CDN

200 Tx/Rx; selectable bandwidth, orders, search range; print to file screen or printer; on line help; summary of hits on each Rx; search for adjacent channels; INTERMOD SOFTWARE, 1254 Gillmor Cres, Prince Albert, Sask., CANADA S6V 6A7.

Circle (464) on Fast Fact Card

TOWER SPACE SOUTHERN CALIFORNIA

28 sites ranging from Santa Barbara to Mexican Border. Stand-by power.

Ask for Jack Reichler
MERIDIAN COMMUNICATIONS
23501 Park Sorrento, #213A
Calabasas, CA 91302
(818) 888-7000

Circle (466) on Fast Fact Card

PRIME TOWER SPACE NOW AVAILABLE!

Located west of Cleveland in
Amherst, Ohio. Ground elevation;
750 feet. Tower height 290 feet.
Two-way radio and microwave
availability. Contact:

David A. Laidlaw
SELECT COMMUNICATIONS, INC.
3600 Kolbe, Ste. 111
Lorain, OH 44053

216/282-9922

Circle (467) on Fast Fact Card

TOWER SPACE FOR RENT NORTHERN ILLINOIS & SOUTHERN WISCONSIN

Building & AC power provided.

Contact Wes Minear 815/569-2178

Northern Illinois Radio Services
11124 Cemetery Road • Capron, IL 61012

Circle (468) on Fast Fact Card

ADVANCED INTERMOD PC SOFTWARE — \$175

Up to 10 times faster than prev. versions.
200 Tx and Rx freqs. to 9th order. Help and
tech files; selectable speeds, band widths,
orders. Prints reports in plain English text.
Updates for present users — \$75.

MECH-ELEC SYSTEMS (303) 674-1101

Circle (469) on Fast Fact Card

\$275.00

"MICROWAVE

TCS

\$275.00

"MULTIPOINT"

Quality Microwave and Point-To-Multipoint Calculation Programs

Technical Specifications • Sample Printouts • Information
Technical Communications Software

P.O. Box 884
Montgomery, TX 77356

(409) 582-6637
(Texas: add 6%)

Circle (465) on Fast Fact Card

Classified

Computer products

C\$ERVICE™ Communications Service Shop Computer Software

- Invoicing—T&M/Contract/Rentals
- Customer Files
- Technician Efficiency
- Work Ticket Log/Tracking
- Accounts Receivable—Monthly Statements
- Inventory—Shop/Service Vans
- Maintenance History
- Interface to Peachtree Accounting System
- Radio System Design—Interference Analysis—Distance/Azimuth

All programs are fully interfaced. Multiple companies, multiple shop locations. Available for IBM & compatibles/ Demonstration program available for evaluation.

Packages starting at \$650.00

America West C&E, Inc.
311 Washburn Drive
Rock Springs, WY 82901
307-382-5663

Circle (470) on Fast Fact Card

Repair services

MAXON QUALITY SERVICE

- Excellent turn-a-round—48 hours normal.*
- \$29.50 per hour plus parts.**
- 90-day warranty.
- Return minimum \$19.50.

*When special parts required, return time will be longer.

**Add \$3.50 shpg/hdlg PLUS \$2 for C.O.D.

Summit City Radio, Inc.
4632 Newaygo Rd.
Ft. Wayne, IN 46808
(219) 483-6674

Circle (471) on Fast Fact Card

Portable and Mobile Radio Repair

Regency • Wilson • Octagon
\$30/hour, 2 hrs. max., plus parts
Fast turnaround, UPS paid return,
references available.

TA Enterprises

986 Cherokee Rd., S.E.
Palm Bay, FL 32909 (407) 725-6167

Circle (472) on Fast Fact Card

maxon

REPAIR SERVICE

- Portables/Mobiles
- Telemetry/Data Radios
- Experienced/Licensed

LANCER ELECTRONICS
1321 West Meeting St.
Lancaster, S.C. 29720

(803) 283-9403

Circle (473) on Fast Fact Card

Services

DUPLXERS RETUNED!

Fast service—all makes.
Call Dennis at:

CODEN ENTERPRISES
(716) 828-0290

Circle (474) on Fast Fact Card



HELIOPOWER INC.

ONE CENTENNIAL PLAZA 3F PISCATAWAY NJ 08854

Your partner in solar power system design

APPLICATIONS ENGINEERING
HOXAN PHOTOVOLTAIC PRODUCTS
REMOTE POWER SYSTEMS
201-980-0707

A JOINT VENTURE OF AMERICAN-STANDARD AND HOXAN

Circle (475) on Fast Fact Card

SERVICE INSTRUCTION

37 lessons & tests written exclusively for mobile communications servicing. No Radar, No TV. Home Study. \$375. Time payments available. Established 1960.

Mobile Training Institute
528 Pacific Terr. P.O. Box E
Klamath Falls, OR 97601-0021



(503) 882-5408

Circle (476) on Fast Fact Card

Cellular services

WHOLESALE RSA APPLICATIONS

Price varies according to volume.
Call for a quote: (606) 278-1888

Cellular | Sells, Inc.

Lowell E. Ferguson
President

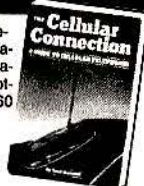
256 Melbourne Way
Lexington, KY 40503
(606) 278-1888

Circle (478) on Fast Fact Card

PERFECT FOR MARKETING PERSONAL & CONSUMER LEAD GENERATION

INCLUDES: How Cellular Works; Selecting a Phone and a Carrier; Features and Services; Operation; Installation; Data Transmission; Troubleshooting. Easy to understand. Illustrated 160 pages.

Send \$9.95 + \$2 postage to:
QUANTUM PUBLISHING
Box 310B, Mendocino, CA 95460
(707) 937-4488



Circle (479) on Fast Fact Card

63,661 sales opportunities. 54 dollars.

With *MRT Classified*, you get your sales message to 63,661 mobile communications equipment and service buyers. For only \$54 for a one inch ad!

So, when you need **FAST ACTION**, it doesn't have to cost you an arm and a leg.

Call *MRT Classified*, at (303) 762-1249. Ask for Diane.

PRIVATE CARRIER PAGING

(Everything you ever wanted to know made simple!)



The opportunity of this decade is **Private Carrier Paging (PCP)**. If you would like to know how easily (and inexpensively) you can share in this dynamic growth industry, call us! We wrote the book (the only book); on **PCP**, We will teach you how to license your system, calculate your return on investment, select the right equipment, and successfully market your services. Our **PCP Primer** for only \$95.00 tells all. **SATISFACTION GUARANTEED. Call or write—TODAY!**

(205) 854-2611



**NU-WAY
MARKETING INC.**

#36 - 20th Avenue, N.W.
Birmingham, AL 35215

Circle (477) on Fast Fact Card

Cellular Equipment

PANASONIC Transportable Kits

Soft-pack type, \$89.00 Includes power cable and antenna. Low cost way to convert your 310 or 311 into a transportable. Call:

1-800-521-6474

Circle (480) on Fast Fact Card

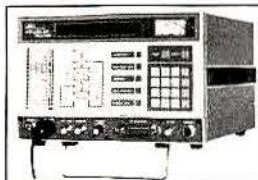
ATTENTION DEALERS INTRODUCING THE WORLD'S MOST INEXPENSIVE CELL-SITE SIMULATOR BY JAPAN RADIO CORPORATION

FOR
ONLY

\$7995.⁰⁰

While supplies last

Mfgs. Retail
\$10,400.00



PERFORMS FULL CELL-SITE
SIMULATIONS LIKE MOTOROLA,
MARCONI, IFR, CUSHMAN, ETC.

FOR INFORMATION CALL:

C.S.C. INC. (713) 688-8800

U.S. Authorized Factory Distributor

Circle (481) on Fast Fact Card

BIG RESULTS.

A Small Investment.

You will reach over 63,661* sales prospects in **Mobile Radio Technology** Classifieds. Prospects who are qualified to buy your products and services. For just \$54 a column inch. Frequency discounts available. Call Diane Hite at (303) 762-1249.

* Harvey Research, New York, 1988.

Sales offices

Associate Publisher/National Sales Manager

Mercy Contreras
First National Bank Building
333 W. Hampden, Suite 606
Englewood, CO 80110
Telephone: 303-762-1249
Telefax: 303-762-0069

MIDWEST: Englewood, CO Cathey Bonnefoi, Marketing Manager

First National Bank Building
333 W. Hampden, Suite 606
Englewood, CO 80110
Telephone: 303-762-1249
Telefax: 303-762-0069

EAST: Englewood, CO

Ruth Breashears
First National Bank Building
333 W. Hampden, Suite 606
Englewood, CO 80110
Telephone: 303-762-1249
Telefax: 303-762-0069

WEST: San Rafael, CA

Dennis Hegg, Marketing
Manager
950 N. Gate Drive, Suite 207
San Rafael, CA 94903
Telephone: 415-491-1442
Telefax: 415-491-1842

CLASSIFIED SALES

Englewood, CO

Diane Hite, Classified
Marketing Manager
First National Bank Building
333 W. Hampden, Suite 606
Englewood, CO 80110
303-762-1249
Telefax: 303-762-0069

EUROPE:

Nicholas McGeachin
Roseleigh House
New Street, Deddington
Oxford, OX5 4SP England
Telephone: (0869) 38794
Telefax: (0869) 38040
Telex 837469 BES G

JAPAN:

Mashy Yoshikawa
Orient Echo, Inc.
1101 Grand Maison
Shimomiyabi-Cho, 2-18
Shinjuku-ku,
Tokyo 162 Japan
Telephone: 03-235-5961
Telex: J-33376 MYORIENT

A d index/hotline

Company	Page Number	Fast Fact Number	Advertiser Hotline	Company	Page Number	Fast Fact Number	Advertiser Hotline
Advanced Electronic Applications Inc.	58	56	206/775-7373	Marconi Instruments	25	19	800/233-2955
Advanced Receiver Research	103	113	203/582-9409	Maxon	73	71	816/891-6320
Aerotron Inc.	20	15	919/872-4400	METS Inc.	71	69	317/876-4640
Alexander Mfg.	53	48	515/423-8955	Microlink Inc.	98	105	713/488-6011
Allgon Antenna Inc.	67	56	214/641-3887	Mobile Mark Inc.	108	118	312/671-6690
Antenna Specialists Co.	IFC	1	216/349-8400	Motorola Govt. Elec. Group	59	57	800/367-2346
Argus Electronics, Inc.	115	442	800/325-4833	Motorola/Radiu	43	36	800/622-0030
Astron Corp.	39	33	714/458-7277	Multiplier Industries Corp.	47	40	800/642-2424
Band-It-Index	24	18	303/320-4555	MX-COM Inc.	72	70	919/744-5050
Beam Radio	18	13	305/477-2326	N.C.E. Inc./Power Group			
Bee Electronics Inc.	100	109	800/336-3115	International	82	84	612/890-1360
Bendix/King	93	98	913/842-0402	Naber	64	63	800/759-0300
Bird Electronic Corp.	78	77	216/248-1200	Norcomm Corp.	48	42	800/874-8663
Bogner Broadcast Equipment Corp.	52	47	516/997-7800	Omnicon Electronics	94	100	203/928-0377
Bomar Crystal Co.	34	29	800/526-3935	Ora Electronics	13	10	818/701-5848
Bramco	30	23	513/773-6255	Outlook Corp./Hawa USA Inc.	101	110,111	702/731-4776
BYTEK Corporation	86	89	800/523-1565	Pac-Comm Wireless Data Sys. Inc.	104	114	813/875-6417
C T Systems	17,87	12,91	800/245-6356	Positron Industries	60	59	514/738-2200
Centurion International, Inc.	55	52	800/228-4563	Primus Electronics Corp.	94	99	800/435-1636
CES Inc.	7	7	800/327-9956	Quintron Corp.	95	101	217/223-3225
Cetec Vega	1	4	818/442-0782	R F Gain Ltd.	92	96	800/645-2322
David Clark, Co., Inc.	41	35	617/756-6216	R F Industries	90-91	95	800/233-1728
Coaxial Dynamics, Inc.	76	74	216/267-2233	Ramsey Electronics	74	72	716/586-3950
Coded Communications	57	55	800/325-0147	Reach Electronics	76	75	308/324-6661
Communications Associates	62	61	800/435-9313	Regency Land Mobile	79	79	800/428-5000
Communications Specialists	BC	3	800/854-0547	Repco Inc.	37	31	305/843-8484
Computer Resources Inc.	96	103	205/591-8810	Ritron Inc.	105,107	115,117	317/846-1201
Connect Systems Inc.	19,109	14,120	213/373-6803	Royal Insurance	61	60	
Continental Leavitt Comms. Ltd.	89	93	312/982-0220	Savoy Electronics Inc.	100	108	800/327-1282
Control Signal Corp.	49	43	303/989-8000	Schlumberger Instruments	97	104	617/229-4825
Controlonics Corporation	46	39	800/233-8639	Securiton Co.	99	107	408/263-6434
Cortana Corp.	82	83	505/325-5336	Selectone Corp.	81	82	800/227-0376
Curtis Electro Devices, Inc.	54	49	800/332-2790	Setcom Corp.	32	27	415/965-8020
Data Signal Inc.	40	34	912/883-4703	Shinwa Communications of Am.	8	8	405/232-7272
Decibel Products, Inc.	33	28	214/631-0310	Sigtone Inc.	88	92	213/463-4474
Dictaphone Corp.	63	62	800/342-8439	Sinclair Radio Laboratories	9	9	716/874-3682
EMR Corp.	60	58	602/978-5766	Solid State Communications	3	5	415/785-4610
Erie Electronics, Inc.	80	80	716/833-8400	Speco Div. Components			
Freeman Engineering Associates Inc.	75	73	504/831-7785	Specialties Inc.	50	44	800/645-5516
Fujitsu Ten Corp. of America	29	22	800/421-1996	Standard Communications Corp.	83	85	213/532-5300
GE Mobile Communications	21	16	800/GE1-2345	Sti-Co. Industries Inc.	108	119	716/881-3287
Helper Instruments Co.	54,80	50,81	800/327-9308	Sweet Electronics	84	86	618/939-3870
Henry Radio	45	38	213/820-1234	Syntonic Technology	22		800/233-2365
Hutton Communications	106	116	800/442-3811	TDI Batteries	84	87	800/323-7307
I.D.E.A., Inc.	92	97	912/333-0726	Telewave Inc.	31	25	415/968-4400
Icom America Inc.	15	11	206/454-8155	Telocator	110	121	800/422-4862
IFR Systems, Inc.	69	67	316/522-4981	Tessco	96,99,64A-64B	102,106	800/638-7666
International Crystal Mfg. Co., Inc.	68	66	405/236-3741	Tessco	32,48,65	26,41	800/638-7666
ISC Cardion Electronics Inc.	85	88	516/289-6200	TPL	56	53	213/256-3000
Jan Crystals	54	51	813/936-2397	Transcrypt Intl. Inc.	5	6	800/228-0226
Kathrein Inc.	28	21	216/289-1271	Trylon Mfg. Co.	56	90	519/669-5421
Larsen Electronics Inc.	27	20	206/573-2722	TX RX Systems	70	68	716/549-4700
Magnavox	51	46	516/667-7710	Uniden Corp. of AM-MSG Inc.	77	76	800/421-8894
Magnum Distribution Inc.	102	112	206/676-7775	Unipage, Inc.	23	17	214/224-3509
				Vocom Products Corp.	44	37	312/885-3296
				W & W Associates	38	32	800/221-0732
				White, Brian R., Co. Inc.	30	24	707/462-9795
				Yaesu USA	IBC	2	213/404-2700
				Zetron Inc.	35	30	206/644-1300
				ZK Celltest Systems	50	45	408/735-7076

Yaesu... charting new frontiers.

At Yaesu, we are constantly expanding our horizons to bring you the latest in mobile and hand-held radios and a full line of accessories. Visit your Yaesu dealer today for a look at this exciting array of transceivers... and don't forget to ask about our evolutionary new dual-band!

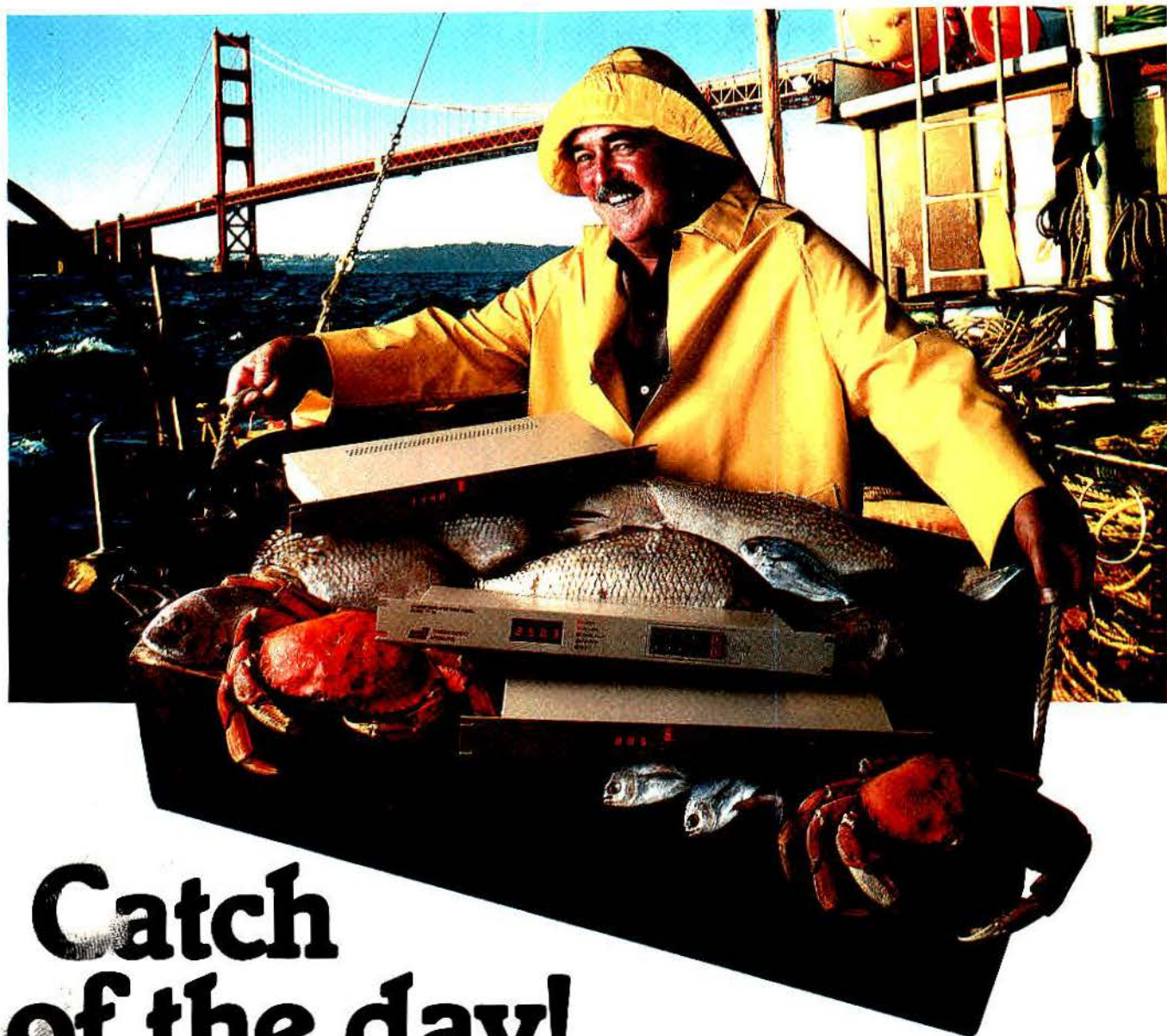
Call or write us for more information on how you can explore the future with Yaesu today.

YAESU U.S.A.

Commercial Products Division
17210 Edwards Rd., Cerritos, CA 90701
Telephone: (213) 404-2700



Circle (2) on Fast Fact Card



Catch of the day!

Have you been trawling the bounding main for a new product? We have just netted it—the TP-38 microprocessor controlled community repeater panel which provides the complete interface between the repeater receiver and transmitter. Scuttle individual tone cards, all 38 EIA standard CTCSS tones are included as well as time and hit accumulators, programmable timers, tone translation, and AC power supply at one low price of \$595.00. The TP-38 is packed like a can of sardines with features, as a matter of fact the only additional option is a DTMF module for \$59.95. This module allows complete offsite remote control of all TP-38 functions, including adding new customers or deleting poor paying ones, over the repeater receiver channel.

Other features include CMOS circuitry for low power consumption, non-volatile memory to retain programming if power loss occurs, immunity to falsing, programmable security code and much more. The TP-38 is backed by our legendary 1 year warranty and is shipped fresh daily. Why not set passage for the abundant waters of Communications Specialists and cast your nets for a TP-38 or other fine catch.



\$595.00 each

\$59.95 DTMF module

\$149.95 Digital CTCSS module

*Now available with
Digital CTCSS*



COMMUNICATIONS SPECIALISTS, INC.

426 West Taft Avenue • Orange, CA 92665-4296
Local (714) 998-3021 • FAX (714) 974-3420
Entire U.S.A. 1-800-854-0547



Circle (3) on Fast Fact Card